

San Francisco Bay



Crossings Study



METROPOLITAN
TRANSPORTATION
COMMISSION



July 2002
Final Report

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Executive Summary

A major new San Francisco Bay crossing has intrigued the public for a long time. The most recent interest in new crossing options reflects the dramatic rise in traffic and congestion resulting from the latest economic expansion in the Bay Area and the continuing separation of jobs and housing in the region.

The 2000 *San Francisco Bay Crossings Study* updates the findings from a 1991 study on the same subject.

Transbay travel over the next 25 years is expected to increase by 40 percent, outpacing the average regional rate of growth in travel. A large set of potential solutions to meet this growing demand was proposed in the scoping stage of the 2000 study. The study focused on the major themes and strategies that arose out of an extensive public outreach process. Six final alternatives were defined and evaluated to determine their cost, travel, environmental and social impacts.

Several parallel efforts are under way. The new Bay Area Water Transit Authority is formulating a proposal to augment and expand ferry service on the Bay; its plan is to be submitted to the state Legislature in December 2002. A regional “smart

growth” planning initiative also is under way and will define an alternative land-use development pattern that, if implemented, could result in significantly lower levels of transbay travel than currently projected in this study.

The study’s Policy Committee expressed a strong interest in exploring lower-cost operational improvements that could be implemented as a near-term response to traffic congestion in the bridge corridors. In addition, there is an opportunity to seek new regional funding from a possible increase in Bay Area bridge tolls (state Sen. Don Perata’s initiative) to improve transbay travel options by all modes. This study’s recommendations for near-term implementation include improvements that could be funded with existing funds as well as improvements that could be funded from a possible \$1 increase in the toll on the Bay Area’s state-owned bridges.

Major new crossing improvements will be extremely costly, in some cases requiring funding equal to or exceeding the entire amount of new regional funds estimated to be available over the next 25 years in MTC’s latest *Regional Transportation Plan*.

Summary of Conclusions by Alternative

Alternative 1 — Express bus, carpool and operational improvements

This is one of the most cost-effective alternatives studied. These improvements can be tailored to meet evolving needs, developed as separate projects, and fit within funding constraints. Analysis of this alternative indicates that a regional express bus system could help serve future transit demand, and carpool-lane improvements could provide significant travel-time savings for carpoolers. Assuming successful implementation of current plans to address capacity issues, projected demand for transbay BART service can be handled primarily by adding trains and by strategies to facilitate faster loading/unloading of trains in San Francisco.

Alternative 2 — New BART and or/conventional rail tunnel in Bay Bridge corridor

The public expressed keen interest in crossings that involve BART, conventional and high-speed rail. A new rail crossing should be viewed as a very long-term investment, to serve transit demand beyond 2025, and to improve transit reliability and redundancy. A BART or rail tunnel under the Bay would be the most costly of the six alternatives studied. Overall, this alternative would produce the highest level of transit use, but the high cost and modest travel-time savings place it low on the cost-effectiveness scale. It also could have significant environmental impacts.

Alternative 3 — Reversible lane and widening of San Mateo-Hayward Bridge to eight lanes

Near-term travel improvements are expected to occur in this corridor with the opening of the new six-lane causeway in late 2002. As traffic grows and demand approaches the capacity of the widened bridge, a reversible lane would be an inexpensive and cost-effective way to address peak-direction demand in the near term. Beyond the reversible lane, the bridge could be further widened to eight lanes to serve projected San Mateo Bridge corridor traffic through at least 2025. The public generally favors widening the existing bridge over building a new bridge crossing. The corridor does not exhibit a strong transit market, limiting feasibility of rail or other major transit investments. Community concerns focused largely on the impacts of a potential need for widening Interstate 880. This issue would need further study.

Alternative 4 — New bridge between Interstate 238 and Interstate 380

A new mid-Bay bridge would have the greatest impact on reducing traffic congestion in the bridge corridors. Corollary effects include significant reductions of traffic on the San Mateo-Hayward Bridge, and a reduction in the duration of the peak period as well as a marginal decrease in peak-period traffic on the Bay Bridge. A new six-lane mid-Bay bridge with bicycle lanes and some express bus service would come at a high cost. Environmental impacts include displacement of residents and businesses near the expanded I-880/I-238 interchange. A new bridge engendered the strongest public reaction, both pro and con.

Alternative 5 — Dumbarton rail service

This is one of the least expensive and most cost-effective of the transbay improvements studied. Initiating rail service by rebuilding the existing Dumbarton rail bridge is popular with the public, even though it likely will have limited impact on traffic in the corridor. Funding for the basic reconstruction of the rail bridge is included in the current *Regional Transportation Plan*, although the cost of completing the necessary restoration of the bridge likely will exceed current funding. The basic start-up service would connect the Union City BART station with Caltrain destinations north and south of the bridge, serving some 3,000 to 4,000 daily riders in 2025.

Alternative 6 — New Dumbarton Bridge approach road to the south

A new southerly approach road to the Dumbarton Bridge could provide more direct access to travelers heading to jobs in Silicon Valley and communities south of the bridge. An expanded approach road system would alleviate regional through-traffic impacts on local communities. Much of a new two- to four-lane road between the Dumbarton Bridge and U.S. 101 would be below grade or in a tunnel to minimize environmental impacts and, as a result, would have a high construction cost.

In addition to the alternatives themselves, several policy-related measures also were evaluated to determine their impact on transbay travel. They included:

- peak-period congestion pricing on the bridges;
- smart growth land use; and
- increasing carpool-lane occupancy requirements to 3+ on the San Mateo and Dumbarton bridges and taking a lane on all three Bay bridges for carpools and buses.

Summary of Recommendations

Near-term recommendations included:

- 1) using existing funds to pursue the re-establishment of express bus service on the San Mateo-Hayward Bridge to test the transit market under current conditions, and proceed with very low-cost projects in Alternative 1 that have been determined to provide significant near-term operational benefits.
- 2) pursuing new bridge toll funding opportunities for reversible lanes on the San Mateo-Hayward Bridge, Dumbarton rail basic service, additional carpool-lane improvements, and BART core-capacity improvements.

Recommendations for further study included:

- higher-cost bridge carpool-lane improvements;
- Dumbarton approach improvements;
- BART core-capacity enhancements;
- specific transbay express bus proposals, a San Mateo-Hayward Bridge reversible-lane designation for 2+ carpool use (to be studied in MTC's *HOV-Lane Master Plan Update* in 2002–03) and potential to take an existing lane for a dedicated HOV/express bus lane on the Bay Bridge; and
- feasibility and operation of a San Mateo-Hayward Bridge reversible-lane.

As a follow-up, it was recommended that MTC:

- continue coordination with the High-Speed Rail Authority and the San Francisco Bay Area Water Transit Authority;
- support continuing work to develop regional consensus on a smart-growth land-use alternative; and
- add widening of the San Mateo-Hayward Bridge to the list of “Blueprint” projects in the next update of the *Regional Transportation Plan*.

SECTION

1 Introduction

Background: A History of San Francisco Bay Crossings Studies

Several times over the past 30 years, Bay Area transportation planners, officials and voters have considered proposals for a new toll bridge crossing the San Francisco Bay south of the existing San Francisco-Oakland Bay Bridge. The focus of these earlier proposals and studies revolved around the concept of a new auto bridge located approximately four miles south of the San Francisco-Oakland Bay Bridge. The now-defunct California Toll Bridge Authority authorized a new bridge in April 1966, extending from India Basin in San Francisco to Alameda, Oakland and San Leandro, and appropriated funding for a study and preliminary design. This alignment was studied in 1971. In a 1972 proposition, Bay Area residents of six counties were given a chance to vote on this new bridge, which they rejected. Environmental concerns and concerns about the impact of a new auto bridge on the nascent BART transbay service were key issues in the election.

Most Recent Work: *The 1991 San Francisco Bay Crossing Study*

Until this current study, the most recent evaluation of transbay travel improvements was the 1991 MTC study done in response to state Senate Concurrent Resolution (SCR) 20, authored by then California state Sen. Quentin Kopp. SCR 20 specifically cited current and growing congestion on the San Francisco-Oakland Bay Bridge and BART as a reason for considering improvements to transbay travel. However, rather than focusing solely on a new auto bridge, the *1991 Bay Crossing Study* examined 11 different “build” alternatives for improving transbay travel. These ranged from new bridges and tunnels for cars and/or rail, to ferries,

to airport-to-airport connections (i.e., San Francisco to Oakland Airport). The options were narrowed to five major concepts:

1. High-Speed Ferry Service
2. Interstate 380 to Interstate 238 Bridge With BART
3. BART SFO/OAK Airport Connection
4. New BART Transbay Tube
5. Intercity Rail Connection

Some key findings from the *1991 Bay Crossing Study* were that:

- Planned and programmed improvements at the time, including widening of the San Mateo-Hayward Bridge and more frequent BART service, would provide enough capacity to accommodate transbay travel to the year 2010, but at high and increasing levels of congestion.
- The new bridge plus BART would carry the greatest number of trips of the five alternatives studied in detail. While peak-hour volumes on the existing San Francisco Bay Bridge would not be reduced, the duration of the peak period would be reduced by more than one hour.
- The new bridge/BART alternative would have significant land-use impacts, including displacement of homes and businesses, and destruction of wetlands.
- Tunnel options would have significant environmental impacts due to dredging. Bay water quality would be impacted and disposal of a very large amount of dredge spoils would have to be addressed.

Map of Study Area



What new issues/concepts have surfaced since the 1991 study?

The 1991 *Bay Crossing Study* examined the issue of improving transbay travel in a more comprehensive and thorough way than had previously been done. Nevertheless, since 1991, new issues have arisen that suggest re-examination of transbay travel issues may be warranted. A partial list of these issues is as follows:

- *Need to Look Beyond 2010 (the horizon for the 1991 study):* Any major investment will take a number of years to complete and could have a useful life of 50 years or more. Updated regional growth forecasts also need to be considered.
- *Operational/System Management Options:* In recent years, a greater understanding and more information are available on how to better operate and manage traffic congestion. New tools are available, such as traffic operations systems (TOS) and intelligent transportation systems (ITS). Recent MTC corridor studies have utilized these tools to develop traffic management approaches for reducing congestion and improving mobility.
- *New Rail Transit Services:* While rail options were considered in the 1991 *Bay Crossing Study*, the Capitol Corridor and Altamont Commuter Express (ACE) are rail services that are now operational. The state High-Speed Rail Authority also has developed plans for serving the Bay Area if the project is implemented.
- *San Francisco-Oakland Bay Bridge Rail Study:* This study by MTC analyzed placing rail on the Bay Bridge as recommended in voter referendums in Alameda and San Francisco counties.
- *Incorporation of Dumbarton Rail Study:* Recent work in this corridor by the Caltrain Joint Powers Board and Dumbarton Corridor Task Force has produced a proposal for initiating rail service over the Dumbarton rail bridge between the Union City BART station and the Peninsula.
- *New Water Transit Authority:* State legislation created a new Water Transit Authority to plan expansion and operation of ferry service beyond existing routes.

Current Bay Crossings Study

Efforts by MTC and Caltrans to replace the east span of the Bay Bridge for seismic safety reasons also raised new issues about the need for new transbay capacity. With the rapid expansion of the Bay Area's economy due to the high-tech sector, traffic was again increasing noticeably on all three central Bay bridges and the rebuilt east span would not increase the capacity of the existing Bay Bridge. (The replacement would, however, add shoulders to the bridge.)

In November 1999, Sen. Dianne Feinstein wrote Gov. Gray Davis, stating that,

"A regional traffic and transportation study for the Bay Area with respect to alternative Bay crossing and other options to increase the capacity and mobility for transbay travel between San Francisco, the East Bay and the Peninsula must be undertaken promptly."

Sen. Feinstein specifically cited the need to review and update the 1991 SCR 20 study. MTC staff subsequently submitted a grant request to Caltrans and the California Transportation Commission for funding a transbay study, and this request was approved.

SECTION

2 Current and Projected Transbay Corridor Travel Conditions

Current Travel Conditions

Transbay trips are 4 percent of all regional trips and 7.9 percent of regional work trips. In total, approximately 806,000 people travel in the San Francisco-Oakland Bay, San Mateo-Hayward, and Dumbarton bridge corridors by transit or car every day. Of these, approximately 590,000 travel the Bay Bridge corridor, 109,000 travel the San Mateo-Hayward Bridge corridor and 107,000 travel the Dumbarton Bridge corridor. Figures 1 and 2 present a summary of the daily person-trips made in the study area each day.

Figure 1:
Average Daily Person-Trips by Bridge Corridor

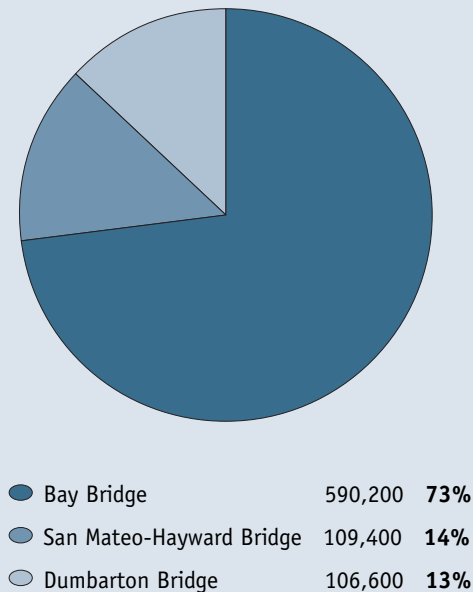
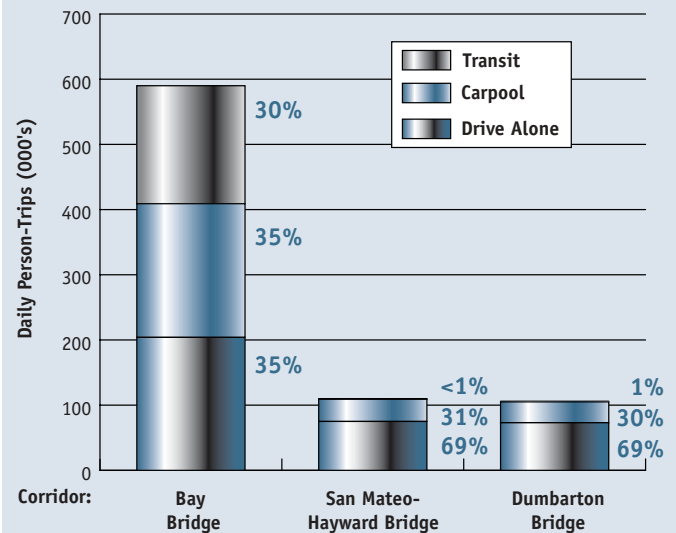


Figure 2:
Person-Trips in Bridge Corridors by Travel Mode



Bay Bridge

The Bay Bridge corridor is the most heavily traveled of the three transbay corridors. Table 1 shows the modal split for travel in the corridor. Travel is split fairly evenly among carpools, transit and single-occupant vehicles.

Traffic

Average weekday traffic volumes are 146,200 in the eastbound direction and 141,300 in the westbound direction (287,500 daily total). In the morning, the predominant commute direction is westbound and in the evening, the predominant commute direction is eastbound. In general, weekday traffic peaks between 6 a.m. and 10 a.m. in the westbound direction and between 4 p.m. and 7 p.m. in the eastbound direction. During the morning peak period, the peak direction carries 53 percent to 67 percent of total traffic. During the evening peak period, the peak direction carries 54 percent to 58 percent of total traffic. On Saturdays, the Bay Bridge carries approximately 292,500 vehicles, while on Sundays, the bridge carries approximately 262,000 vehicles.

Table 1: Average Weekday Bay Bridge Trips

Mode	Number of Persons Carried	Percentage of Total Trips
Single-Occupant Vehicle	204,100	34%
Carpool (2 person)	69,000	12%
Carpool (3+ person)	136,300	23%
BART	160,700	27%
AC Transit	15,200	3%
Ferry	4,900	1%
TOTAL	590,200	100%

The primary westbound bottleneck in the Bay Bridge travel corridor is the toll plaza/metering lights. At this location, three freeways, Interstates 80, 580 and 880, feed into the toll plaza. Westbound vehicles pay the toll at the plaza and are metered by a bank of metering lights just west of the toll booths. The metering lights are intended to feed traffic onto the Bay Bridge at just below its capacity, eliminating bottlenecks further west.

**Figure 3:
Bay Bridge Toll Plaza, A.M. Peak**



In the eastbound direction, the primary bottleneck exists at the western end of the Bay Bridge. At this location, heavily traveled ramps from San Francisco (Bryant Street ramps, 5th Street, Essex Street and 1st Street) enter into the mainline traffic flow from the south. Substantial queues build up on the ramps in the evening peak hour, extending for some distance on San Francisco city streets. On mainline I-80, the eastbound queue extends onto U.S. 101, well beyond the I-80 interchange during peak periods.

Transit

The Bay Bridge corridor has a robust transit network composed of BART, AC Transit and ferries. Together, transit operators carry over 180,000 average daily person-trips in the corridor. The majority of transit trips (160,700 daily) are made on BART, followed by AC Transit (15,200) and ferries (4,900).

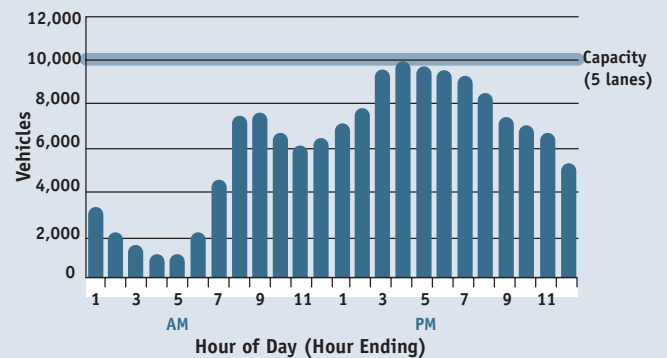
Four of BART's five lines provide service in the Bay Bridge corridor for a total of 27 trains per hour during peak periods. The morning peak hour for BART ridership is 7:30 a.m. to 8:30 a.m., during which time BART carries 13,900 westbound transbay trips and 6,000 eastbound transbay trips. Approximately 12 percent of daily BART trips take place during the morning peak hour. The evening peak hour for BART ridership is 5:30 p.m. to 6:30 p.m., during which time BART carries 13,200 eastbound transbay trips and 6,600 westbound transbay trips. Approximately 11.6 percent of daily BART trips take place during the evening peak hour. High load factors, exceeding BART's policy levels, occur on some peak-hour trains.

AC Transit's 37 transbay routes carry 15,000 daily transbay riders. Transbay ridership peaks in the morning between 7 a.m. and 8 a.m., with 2,200 westbound riders, and between 5 p.m. and 6 p.m. in the evening, with 3,000 eastbound riders. Eastbound ridership is higher than westbound ridership because a number of people who form casual carpools for the morning commute return by AC Transit in the evening.

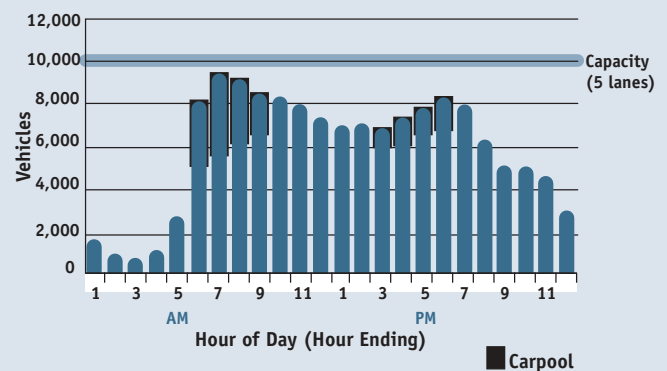
Three ferry routes carry 4,900 daily transit riders in the Bay Bridge corridor. The Vallejo Baylink ferry route carries 2,700 passengers a day, over half of all ferry passengers. The remaining passengers take the Oakland/Alameda ferry service or the Harbor Bay ferry service.

**Figure 4: Bay Bridge Traffic Summary
(Average Weekday Traffic)**

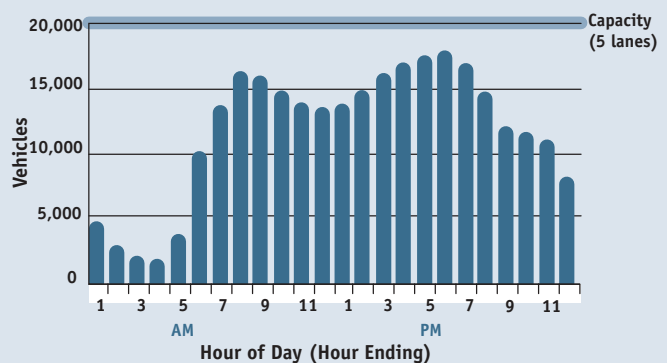
Bay Bridge Eastbound I-80



Bay Bridge Westbound I-80



Bay Bridge Two-Way I-80



San Mateo-Hayward Bridge

Single-occupant vehicles account for two-thirds of all trips across the bridge, while carpoolers total 30 percent of all trips. Table 2 summarizes the person-trips on the San Mateo-Hayward Bridge.

Traffic

Average weekday traffic volumes on the San Mateo-Hayward Bridge are 45,400 in the eastbound direction and 44,800 in the westbound direction (90,200 daily total). In the morning, the predominant commute direction is westbound, and in the evening, the predominant commute direction is eastbound. In general, weekday traffic peaks between 6 a.m. and 10 a.m. in the westbound direction and between 4 p.m. and 7 p.m. in the eastbound direction. During the morning peak period, the peak direction carries 56 percent to 67 percent of total traffic. During the evening peak period, the peak direction carries between 56 percent to 61 percent of the total traffic volume. On Saturdays, the San Mateo-Hayward Bridge carries approximately 58,300 vehicles,

Table 2: Average Weekday San Mateo-Hayward Bridge Trips

Mode	Number of Persons Carried	Percentage of Total Trips
Single-Occupant Vehicle	75,300	69%
Carpool (2 person)	20,700	19%
Carpool (3+ person)	13,300	12%
Bus	100	<1%
TOTAL	109,400	100%

while on Sundays, the bridge carries approximately 46,700 vehicles.

In the morning peak commute hour, the San Mateo-Hayward Bridge corridor often operates under congested stop-and-go conditions from the toll plaza to Route 238. The San Mateo-Hayward Bridge toll plaza and the merge area east of the toll booths are currently the primary westbound bottlenecks in the corridor. The limited bridge capacity also is a bottleneck; however, this will be alleviated for the near term with the

**Figure 5:
Route 92 / I-880 Interchange, A.M. Peak Hour**



current widening project. Another bottleneck in the westbound direction is the ramp from southbound I-880 to westbound Route 92. Demand at this ramp regularly exceeds capacity during the morning peak hour, often resulting in standing queues on southbound I-880 extending to Interstate 238. Westbound Route 92 in the section from Hesperian Boulevard to Industrial Boulevard also is a bottleneck.

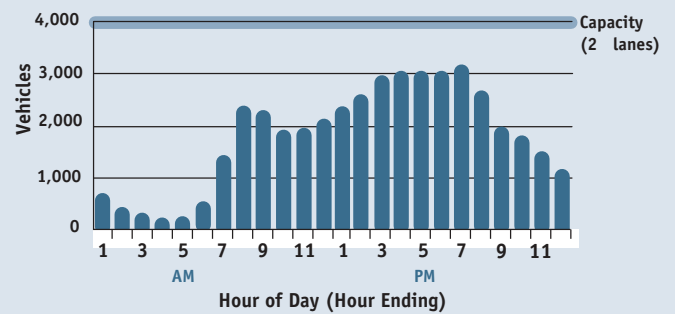
In the eastbound direction, the primary bottleneck occurs at the transition from the high-rise to the causeway bridge section. At this location, eastbound Route 92 narrows from three travel lanes to two. In the evening peak hour, a queue often forms at this merge point and extends westward, at times to U.S. 101. In the eastbound direction, stop-and-go congestion also often occurs on the causeway section and on eastbound Route 92 from the bridge to I-880. On I-880, the one-lane ramp from northbound I-880 to eastbound I-238 also is a primary evening peak-hour bottleneck in the eastbound direction.

Transit

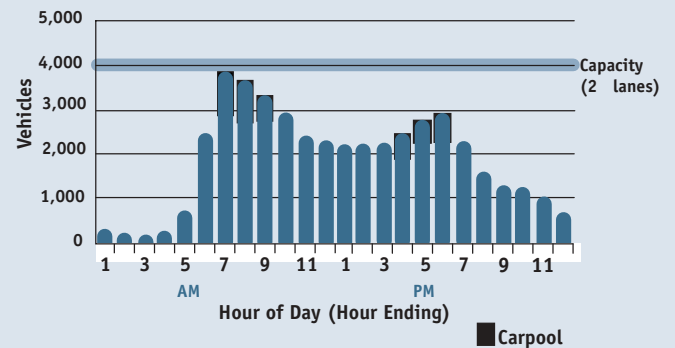
At the time of this study, SamTrans offered limited transit service in the corridor. Shuttle service is provided during commute periods only between the Hayward BART station and employers in Foster City. As of February 2001, the service had an average weekday ridership of 110 passengers.

Figure 6: San Mateo-Hayward Bridge Traffic Summary (Average Weekday Traffic)

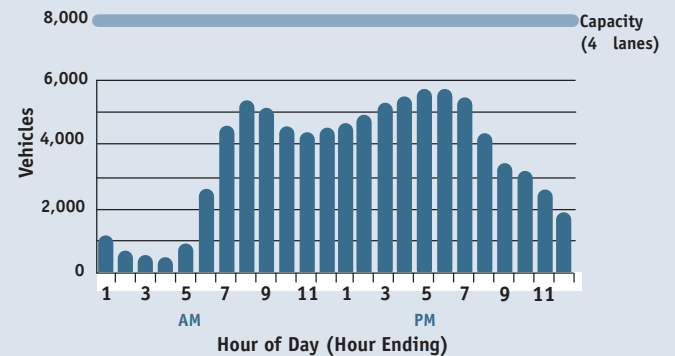
San Mateo-Hayward Bridge Eastbound Route 92



San Mateo-Hayward Bridge Westbound Route 92



San Mateo-Hayward Bridge Two-Way Route 92



Dumbarton Bridge

Single drivers account for about two-thirds of all trips, with carpoolers accounting for almost 30 percent of all trips. Table 3 summarizes the person trips on the Dumbarton Bridge.

Traffic

Average weekday traffic volumes on the Dumbarton Bridge are 51,000 in the eastbound direction and 43,000 in the westbound direction (94,000 daily total). In the morning peak hour, the predominant commute direction is westbound, and in the evening peak hour, the predominant commute direction is eastbound. In general, weekday traffic peaks between 7 a.m. and 10 a.m. in the westbound direction, and between 4 p.m. and 7 p.m. in the eastbound direction. During the morning peak period, the peak direction carries 62 percent to 65 percent of total traffic. During the evening peak period, the peak direction carries between 70 percent to 72 percent of the total traffic volume. On Saturdays, the Dumbarton Bridge carries approximately 81,700 vehi-

**Table 3: Average Weekday
Dumbarton Bridge Trips**

Mode	Number of Persons Carried	Percentage of Total Trips
Single-Occupant Vehicle	73,300	69%
Carpool (2 person)	20,100	19%
Carpool (3 + person)	12,200	11%
Bus	1,000	1%
TOTAL	106,600	100%

cles, while on Sundays the bridge carries approximately 67,600 vehicles.

Two primary bottlenecks exist in the Dumbarton Bridge corridor. In the morning peak commute hour, the Dumbarton Bridge toll plaza significantly restricts the flow of westbound traffic. Peak westbound traffic volumes on the bridge are 2,800 vehicles per hour, while peak eastbound volumes (with the same three-lane capacity) are 5,500 vehicles per hour, and capacity likely approaches 6,000 vehicles per hour in the west-

**Figure 7:
Dumbarton Bridge Toll Plaza, A.M. Peak Hour**



bound direction. The toll plaza cannot deliver sufficient westbound vehicles to the Dumbarton Bridge.

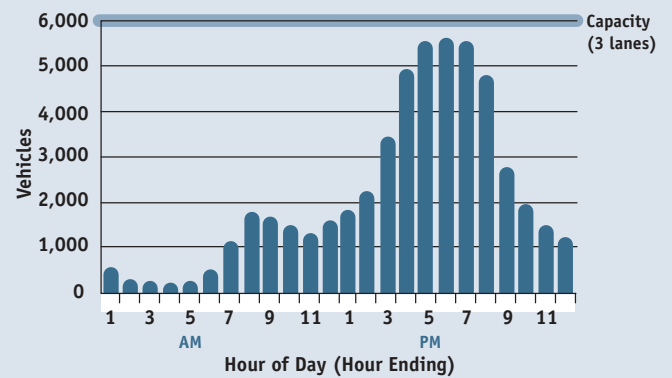
The second primary bottleneck in the corridor is the University Avenue/Route 84 signalized intersection. This intersection restricts traffic flow in both the eastbound and westbound direction. But as indicated by the eastbound and westbound traffic volumes, this restriction is more severe in the eastbound direction. Even if the toll plaza could deliver more eastbound traffic to the Dumbarton Bridge, it is unlikely that the University Avenue intersection could accommodate it.

Transit

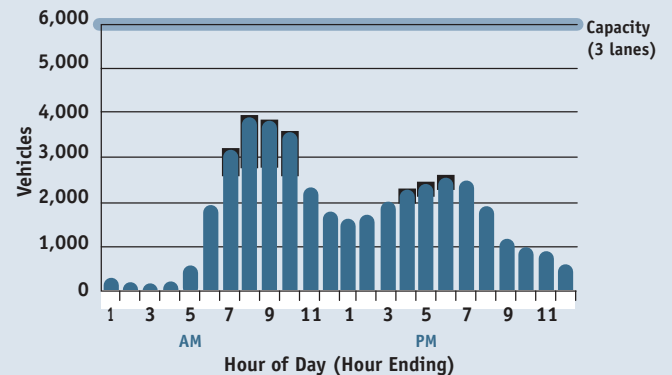
AC Transit operates three Dumbarton Express bus service routes between the Union City BART station and Palo Alto and Menlo Park. In total, the routes carry 1,000 passengers per day.

**Figure 8: Dumbarton Bridge Traffic Summary
(Average Weekday Traffic)**

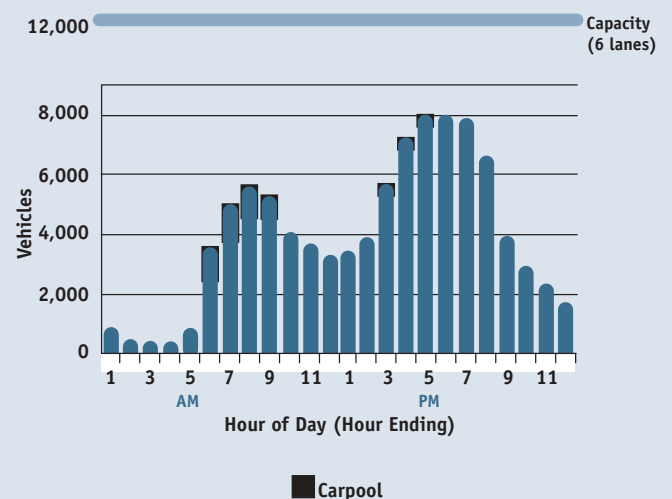
Dumbarton Bridge Eastbound Route 84



Dumbarton Bridge Westbound Route 84



Dumbarton Bridge Two-Way Route 84



Travel in 2025

Future travel in the transbay corridors will be influenced by the magnitude of regional population and job growth as well as the location of this growth throughout the nine Bay Area counties. MTC projects that the number of daily trips in the transbay corridors will increase by about 40 percent over the next 25 years. As a result, transbay travel as a share of all regional travel will increase slightly, to 4.3 percent. (See Figure 9.)

Figure 9: Daily Transbay Trips as Share of All Regional Trips

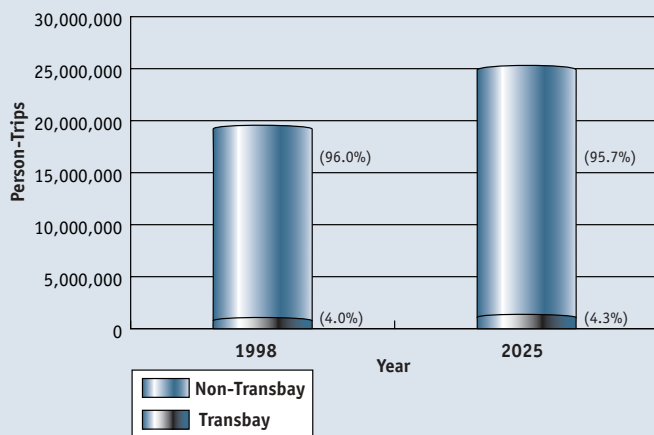


Figure 11: Daily Transbay Vehicular Traffic Growth — Existing to 2025

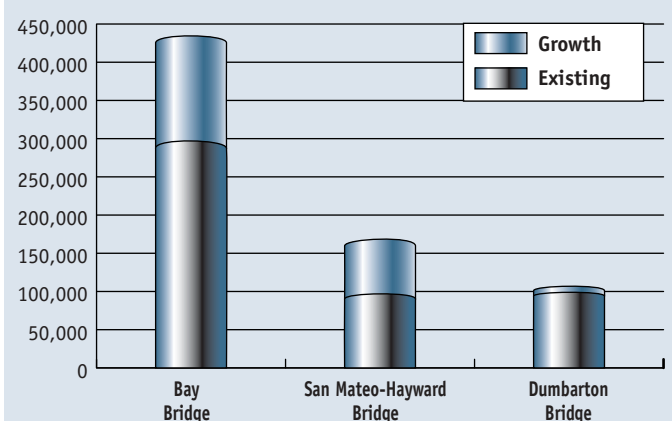
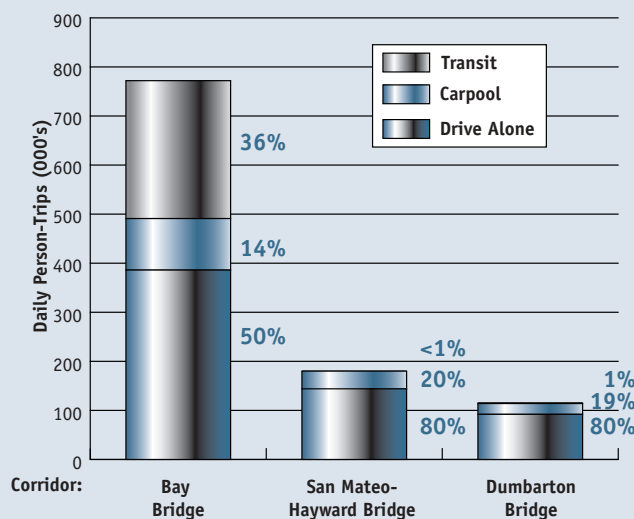


Figure 10: Person-Trips in Bridge Corridors, 2025



The increased number of auto trips will extend the time during which the various bridges are congested beyond the current levels by significant amounts. Analysis done for the toll plaza delay on all three bridges is included in Table 4 below. This table shows that the hours of a.m. peak congestion will increase for all bridges by 18 percent to 50 percent over the next 25 years.

Table 4: Toll Plaza Hours of Congestion A.M. Peak

Toll Plaza	1998 Base	2025 Base	Percent Change
Bay Bridge	4 hours	4 hours 45 minutes	+18.75%
San Mateo-Hayward Bridge	2 hours 40 minutes	4 hours	+50%
Dumbarton Bridge	2 hours 50 minutes	3 hours 50 minutes	+35%

Bay Bridge

Of the more than 1 million transbay person-trips in 2025, 75 percent will be in the San Francisco-Oakland corridor. This corridor exhibits the largest growth in terms of sheer number of trips, from 590,000 today to 772,000 in 2025. As shown in Table 5, transit will continue to play an important role in this corridor, carrying close to 40 percent of daily person trips in 2025. In particular, BART ridership is projected to increase by more than 90,000 persons per day, assuming adequate service levels and parking.

**Table 5: Bay Bridge Corridor, 2025
Trips by Mode**

	Number of Persons Carried	Percent of Total Trips
Single-Occupant Vehicle	386,000	50%
Carpool	105,000	14%
BART	254,000	33%
Express Bus	19,800	2%
Ferry	7,060	1%
TOTAL	771,860	100%

San Mateo-Hayward Bridge

The San Mateo-Hayward Bridge corridor is expected to experience the largest growth in percentage terms. The number of daily person-trips is projected to grow from 109,000 today to nearly 180,000 in 2025, a 64 percent increase. Most trips in this corridor will be by single-occupant vehicle. (See Table 6.) No transit service is assumed in the baseline in this corridor.

**Table 6: San Mateo-Hayward Bridge Corridor, 2025
Trips by Mode**

	Number of Persons Carried	Percent of Total Trips
Single-Occupant Vehicle	144,000	80%
Carpool	35,700	20%
Express Bus	0	0%
TOTAL	179,700	100%

Dumbarton Bridge

A modest amount of growth is expected in the Dumbarton Bridge corridor, given that some east-west trips also can use Route 237. Travel is expected to grow by about 9,000 daily person-trips to nearly 116,000 in 2025. As in the San Mateo-Hayward Bridge corridor, single-occupant vehicle is the dominant mode. Transit will continue to carry about 1 percent of daily person-trips.

**Table 7: Dumbarton Bridge Corridor, 2025
Trips by Mode**

	Number of Persons Carried	Percent of Total Trips
Single-Occupant Vehicle	92,100	80%
Carpool	22,200	19%
Express Bus	1,280	1%
TOTAL	115,580	100%

SECTION

3 Public Outreach and Scoping: What the Public Told Us

Scoping Activities and Public Outreach

The public was involved in the development of the Bay Crossings Study alternatives, conclusions and recommendations through multiple outreach efforts. Two rounds of outreach were conducted. The first round was structured to elicit feedback that would help shape the study alternatives. The second round focused on public reaction to the alternatives under study, including the basis for evaluation. Both rounds used four forums to solicit feedback: public meetings, a telephone poll, focus groups and stakeholder interviews. The different approaches used reflect the diversity and complexity of the issues. These include not only the specific improvements under consideration, but the potential means to fund any of the proposed improvements through higher tolls or other means.

Public Outreach Meetings

There were a total of seven public meetings as a part of the study. Initially, there were three “scoping” meetings to hear suggestions about the need for future transbay improvements and the types of improvements that should be considered. This initial set of meetings took place in: (1) San Leandro, March 13, 2001; (2) San Carlos, March 28, 2001; and (3) San Francisco, March 29, 2001.

Later in the study, after the study team had identified the major improvement packages that would be analyzed, and developed information on these alternatives, a second round of meetings was conducted: (1) Menlo Park, April 30, 2002; and (2) San Leandro, May 1, 2002.

Finally, after the study staff and Policy Committee had developed preliminary conclusions and recommendations, two more meetings were held: (1) in San Francisco, July 10, 2002; and (2) in Oakland, July 17, 2002.

Telephone Polls

Two telephone polls of registered voters were conducted, one in May 2001 and another in May 2002. The first poll contacted 950 registered voters from nine Bay Area counties, to discuss the scoping of potential alternatives. In the following poll, in May 2002, another 900 registered voters were contacted. The two telephone polls generally mirrored the content of the first two rounds of public meetings discussed above.

Focus Groups

A total of four small group meetings were held during the study to engage in interactive discussions about the Bay crossing options. These were facilitated discussions with preset issues under consideration. The first pair of meetings was held in the spring of 2001: (1) in San Carlos on April 24, 2001, and (2) in Oakland on April 27, 2001. The second pair of meetings was held: (1) in San Francisco, on April 16, 2002, and (2) in Oakland, on April 18, 2002.

Stakeholder Interviews

These one-on-one interview sessions were designed to elicit in-depth feedback from a diverse cross-section of stakeholders, including business, labor, environmental groups and elected officials. The stakeholders were from different geographic locations in the region. These meetings provided an opportunity to pursue issues and follow up comments in a way that is not possible in a group meeting. Interviews were held in 2001 and 2002.

Round One: March-May 2001

During the first round of public outreach, general questions were asked, such as:

- (1) What are the most significant transportation problems in the Bay Area?*
- (2) What is your vision of how the transbay corridors should be functioning in the next 20 years?*
- (3) What are your preferred strategies for improving transbay mobility?*
- (4) Should a new transbay facility be for cars, buses, rail, or what combination?*

The focus groups, stakeholder meetings and scoping meetings yielded a wide variety of ideas. In the scoping and focus group meetings, most participants expressed support or opposition to likely crossing ideas, rather than offering ideas about what should be studied. The majority of participants sought transit improvements, especially rail, and many were opposed to a new highway bridge. Those favoring a new vehicle bridge or widening existing bridges also favored a multimodal approach. Supporters of all options emphasized the importance of good connections between a new crossing and other transportation modes on either side of the Bay, whether rail or highway.

The first telephone poll conducted in April and May 2001 revealed voter preferences regarding various types and locations of transbay improvements in somewhat general terms, as the alternatives were loosely defined at that stage. Respondents split nearly evenly when selecting their preferred approach to relieving congestion across the Bay, with 35 percent selecting a new crossing for BART or commuter rail, 30 percent selecting a new bridge or tunnel for cars, trucks and buses, and 27 percent selecting the expansion of bus and ferry services. However, just over half of all respondents (55 percent) expressed support for the general concept of a new bridge or tunnel for vehicles; 34 percent of respondents opposed a new bridge or tunnel. When asked to choose between a new bridge and a new tunnel, more respondents preferred a bridge (46 percent) and fewer preferred a tunnel (26 percent). When asked what type of transit should be included in a new Bay crossing, respondents preferred BART by a wide margin, with 60 percent for BART, 19 percent for commuter rail and 14 percent for express bus improvements.

Respondents were asked where they would like to see a new crossing if one were to be built. Just under half of all respondents (49 percent) preferred a crossing between the Bay Bridge and the San Mateo-Hayward Bridge, north of San Francisco International Airport. The second most popular location, with 39 percent, was between San Francisco International Airport and the San Mateo-Hayward Bridge. The remainder preferred a location between the San Mateo-Hayward and Dumbarton bridges (26 percent) or south of the Dumbarton Bridge (21 percent).

Respondents expressed a high level of willingness to increase bridge tolls to fund transbay improvements. Of all respondents, 66 percent supported a toll increase for a new BART or rail crossing, 60 percent supported a toll increase to widen existing bridges, 61 percent supported a toll increase to fund expanded transbay bus and ferry services, and 57 percent supported a toll increase for a new vehicle crossing.

Round Two: April-May 2002

Participants in round two of the outreach activities were asked questions and had discussions on essentially four areas of inquiry:

- (1) *What do you think are the most important factors or evaluation criteria on which a Bay crossing improvement should be rated?*
- (2) *How would you rate or rank the six alternatives under consideration in this study?*
- (3) *What do you think are the most positive and negative attributes of each alternative?*
- (4) *How should we pay for improvements?*

In addition, because it was feasible to delve into more detail in the stakeholder and focus group meetings, those participants also were asked whether anything in the findings surprised them, and what they saw as the consequence of adopting none of the alternatives.

Responses to each of the six study alternatives, including positive and negative attributes, are presented as part of the discussion in Section 4. Opinions about funding are reported in Section 5. Findings related to public preferences for evaluation criteria are summarized below.

Participants in public outreach groups, focus groups, and stakeholder interviews were asked to rank the evaluation criteria below in order of importance and invited to add other criteria.

The alternatives would be judged on:

- Cost-effectiveness
- Environmental impacts
- Total cost

as well as the extent to which they were likely to

- Reduce traffic congestion and delays
- Add capacity
- Increase transit use.

A few observations are noteworthy about the comparative views among the three outreach groups. Stakeholders and focus group participants ranked “reduce traffic congestion” as a top criterion; however, public meeting participants ranked it third. There was a wider discrepancy in ranking the criterion “increase

transit use.” Stakeholders ranked it as the fifth most important criterion, while focus group and public meeting participants ranked it first and second, respectively. Interestingly, all three groups ranked the “total cost” factor as the least important criterion. This may seem surprising, but one participant summed up the prevalent attitude this way: “If we really want to do something, we’ll find the money somehow.”

For simplicity, participants in the May 2002 telephone poll were asked to rank three evaluation criteria: project cost, number of users, and environmental impacts. Again, project cost ranked last, with just 22 percent of respondents selecting it as the most important criterion, compared to 42 percent selecting number of users and 32 percent selecting environmental impacts.

With respect to environmental factors, participants were asked to comment on what they thought were particular issues of importance. The most frequent comments could be grouped into four themes:

- First, concern about impacts on the Bay itself, primarily wetlands and wildlife.
- Second, concern about disruption to neighborhoods as a result of construction, especially in the East Bay for the major bridge alternatives, San Francisco for the rail alternative, and East Palo Alto/Palo Alto for the Dumbarton approach roads.
- Third, many said that project-specific environmental impacts could be mitigated and overcome with enough money and creativity. As one participant put it, “There should be no real environmental show-stoppers if there’s a project we desperately need and want.” This was consistent with the general view about total cost reported above.
- Fourth, the linkage between land use and transportation was cited repeatedly as both the cause and the solution to many of our transbay problems. The comments took many forms, some of which were contradictory, such as: “Let’s stop growth entirely,” “Support transit-oriented development,” and “Encourage much greater development on the Peninsula to avoid East Bay sprawl.”

Summary Observations

- The public, represented both in surveys and by officials and interest groups, views traffic congestion as a very serious problem that is not currently being handled well by government. Most people view reduction of traffic congestion as the major factor to be used in evaluating transportation improvement alternatives. However, increasing transit mode share — presumably as a means of reducing congestion — is a high priority to many.
- Because a relatively small percentage of voters regularly travel across the Bay, new transbay crossings and improvements to existing crossings tend to rank lower than more general improvements among options to address Bay Area traffic congestion. Just 6 percent to 7 percent of poll respondents reported crossing a bridge on a daily basis. Between 30 percent and 40 percent cross a bridge a few times a month, and an additional 30 percent cross bridges only a few times a year. This helps explain why, in both polling rounds, respondents ranked expansion of BART and commuter rail as the highest priorities and widening existing transbay bridges or building a new bridge as the lowest priorities for addressing Bay Area traffic congestion.
- Total costs and project-specific impacts, while not minimized, are not seen as insurmountable obstacles. The general attitude is that if an improvement project is needed and would achieve desired results, then there should be a way to find the funding and overcome impacts.
- Participants and respondents generally support what they perceive as shorter-term, more easily implementable improvements — based on their estimated costs and scope — more readily than the big-ticket, heavy construction items. In practical terms, this explains why operational improvements/buses/HOV lanes and Dumbarton rail were received more favorably than the heavy rail and bridge alternatives.
- The general public surveyed is considerably more favorable toward BART solutions than are the “activist” public (i.e., those participating in focus groups, stakeholder interviews, and public meetings). The activist skepticism appears to arise from concern about costs and low patronage increases.
- Higher bridge tolls are by far the preferred method to fund any major new transbay crossing, and variable tolls for peak periods have considerable support.

Initial Improvements Considered

Taking all the various ideas from the public into consideration, the study team came up with the following, fairly comprehensive list of ideas for further consideration. More details on each of these can be found in the *Conceptual Definition of Alternatives* report (August 2001).

Improvements to Existing Highway Crossings

● San Francisco-Oakland Bay Bridge:

- (1) Westbound Grand Avenue on-ramp — Extend existing HOV lane to Maritime Street in existing shoulder, with potential extension east of Maritime
- (2) Extend existing westbound I-580 approach left-side HOV lane eastward toward Cypress structure
- (3) Construct new westbound right-side HOV-lane approach/structure alongside I-580 from Route 24 to toll plaza for Route 24 and MacArthur Boulevard traffic only
- (4) Provide a.m. peak-period contra-flow westbound HOV lane along I-580 from Fruitvale Avenue to toll plaza
- (5) I-80 westbound HOV-lane approach — Separate from toll plaza with concrete barrier, improve signage
- (6) Provide a.m. peak-period contra-flow westbound I-80 bus-only lane from I-580 junction to toll plaza
- (7) I-80 westbound mixed-flow approach to Port of Oakland horseshoe ramp — Remove lane drop and extend existing mixed-flow lane to ramp
- (8) I-880 northbound HOV-lane approach — Extend southward in existing inside shoulder to Market/Adeline streets
- (9) Add eastbound HOV lane from toll plaza to I-80/Powell Street
- (10) San Francisco — Convert Essex Street ramp to HOV only
- (11) San Francisco — Extend Bryant Street/2nd Street HOV approach/ramp to Embarcadero

and on Beale Street to Harrison Street — add third southbound lane to Bryant Street with right of way from cruise ship terminal site

- (12) Extend 2nd Street HOV lane eastward to King Street
- (13) Casual carpool restrictions on Fremont Street with carpool unloading zones on Howard and Folsom streets
- (14) Redesign of Sterling Street ramp (improved radius) with improved signage

● San Mateo-Hayward Bridge:

- (1) Widening of San Mateo-Hayward Bridge structure to add additional travel lanes or, as an alternative:

Reversible, mixed-flow lane on high-rise portion of the San Mateo-Hayward Bridge and modification of causeway section to allow six mixed-flow and two HOV lanes

- (2) Route 92 — Toll plaza improvements/expansion
- (3) Route 92 — Close HOV-lane gap — I-880 to Hesperian Boulevard
- (4) Improve Route 92/I-880 interchange — Two-lane off-ramp from southbound I-880 to westbound Route 92, extend westbound HOV lane to Jackson Street, construct direct HOV-lane flyovers — west to north and north to west
- (5) Widen I-880 between I-238 and Route 92 to 10 mixed-flow and two HOV lanes
- (6) Improve I-238/I-880 interchange — Two-lane ramp from northbound I-880 to eastbound I-238

● Dumbarton Bridge:

- (1) Construct East Palo Alto/University Avenue bypass, Phase I to Pulgas Avenue, Phase II to Embarcadero Road/U.S. 101
- (2) Route 84 — Grade separation of University Avenue/Route 84 interchange

- (3) Route 84 — Toll plaza improvement/expansion
- (4) Route 84/I-880 interchange — Construct direct HOV-lane flyovers — west/north and north/west

New Highway/Multimodal and BART/Rail/Other Fixed Guideway Crossings

● New multimodal bridge crossing of Bay — I-238 to south of Candlestick Point

- (1) New multimodal bridge/tunnel crossing of Bay — I-238 to I-380
- (2) New multimodal bridge/tunnel crossing of Bay — I-238 to south of Candlestick Point
- (3) New BART San Francisco subway on Mission or Howard Street with potential Geary Street extension and potential connection with new Transbay Terminal
- (4) New BART transbay tube connecting Mission/Howard streets subway with Oakland via Alameda
- (5) New BART mid-Bay tube or bridge connecting Millbrae to Fremont-South Bay BART line in Hayward
- (6) Rebuilding of Dumbarton rail bridge and initiation of rail service connecting with ACE, BART and Capitol Corridor, including improved trackage/second track through Niles Canyon
- (7) New commuter rail tunnel — San Francisco to Oakland, connecting with electrified, extended Caltrain and upgraded electrified East Bay rail system, compatible with future high-speed rail system
- (8) San Francisco International Airport to Oakland International Airport connector

Express Bus Services

(Note: HOV-lane alternatives detailed above are required to support the express bus alternatives.)

- Express bus service on San Mateo-Hayward Bridge utilizing extension of HOV/bus lane to Jackson Street on Route 92. An HOV/bus lane would be constructed on ramps from Hesperian Boulevard and/or from new park-and-ride facilities.

- Expansion of Dumbarton Bridge express bus service utilizing extension of HOV/bus lane eastward to Mission Boulevard. This service would use a park-and-ride lot with direct HOV ramps at Newark Boulevard/Route 84 interchange
- Expansion of express bus service on Bay Bridge into the new Transbay Terminal
- New express bus service connecting Hayward/San Leandro on I-880 and Route 237 to Sunnyvale/Mountain View (supplementing Capitol Corridor service)

Commuter Rail Services

- Expansion of Capitol Corridor service with light-rail feeder service to Sunnyvale/Mountain View

BART and Other Fixed Guideway Services

- Procure three-door BART cars for transbay lines and revise transbay load-factor standard
- BART has identified the following additional near-term operational improvements under consideration independent of study recommendations:
 - Reduce dwell times at San Francisco platforms (modify train operations and doorway configuration)
 - Operate third track through Oakland (reversible during peak periods)
 - Skip-stop West Oakland (Bay Point trains)

Water-Based Transportation Services

- Implementation of Water Transit Authority's Phase I critical mass transit routes/MTC Blueprint ferry service
- Airport-to-airport hovercraft or ferry
- Oakland-to-San Francisco freight ferry

Other Operational Options and Strategies

- Intelligent transportation system (ITS) improvements to existing crossings and access routes
- Congestion-pricing
- Eliminate toll collection constraint such as through incentives to encourage FasTrak™
- Free transbay bus service

- Expand Bay Bridge free HOV period
- Increase carpool requirement from 2+ to 3+ on San Mateo-Hayward and Dumbarton bridges

The Screening Process

The screening approach involved a combination of:

1. Review of operational strategies: in general, most, if not all, merited further investigation
2. Screening of major crossings concepts, based on traffic, operational, and environmental impacts
3. A review of logical implementation sequences for transportation improvements in a corridor.

No alternatives were screened out based on cost or the fact that they may require a number of years to plan and finance. The list of alternatives that were screened out follows.

Conceptual Alternatives Screened Out

- New Multimodal Bridge — I-238 to south of Candlestick Point; limited approach capacity on U.S. 101 and heavy traffic on Bayshore Freeway at Lagoon Way during peak periods
- New BART Mid-Bay Tube or Bridge Connecting Millbrae to Hayward — Existing transit mode split is very low in the mid-Bay corridor. Furthermore, because this transbay alignment would connect to the Fremont BART line, which generates only 23 percent of transbay ridership, it would likely have low patronage.
- San Francisco Airport to Oakland Airport Connector — An airport-to-airport rail connection would have limited patronage, complex engineering issues, and environmental impacts that would make this concept difficult to implement. Low patronage is due to the fact that San Francisco and Oakland airports serve different air travel markets, limiting the need for most passengers to travel between airports for air service connections.
- Airport-to-Airport Hovercraft or Ferry — As noted above, the two airports serve different air travel markets. Previous hovercraft service was discontinued due to low patronage. It does not appear that conditions would warrant reintroduction of such service.
- Oakland-to-San Francisco Freight Ferry — Stake-

holder interviews identified concerns that such a ferry would not be well utilized. As well, heavy trucks only accounted for 3 percent of traffic on the Bay Bridge. Timesavings from ferry operation are uncertain.

- Free Transbay Bus Service — Preliminary studies did not identify cost as a deciding factor for commuters who might ride transbay buses. Transbay bus service is typically less expensive than driving and parking, while the elimination of transbay fares would result in a loss of revenue for transit operators.
- Expand Bay Bridge HOV Toll-Free Period — This option would result in substantial loss of revenue necessary to fund ongoing bridge seismic retrofit programs. During off-peak periods, it is unlikely that eliminating transbay tolls would generate more car-pools.

SECTION

4 Final Alternatives and Analysis

After the screening phase of the study was completed, the remaining work focused on an in-depth analysis of six packages of transbay transportation improvements. The idea was not necessarily to select a particular package, since they covered three different bridge corridors, but to learn more about how each package contributed to improved mobility. This information was then used to develop a comprehensive set of recommendations covering all transbay corridors.

Six alternatives were identified and evaluated with respect to serving the projected future-year transbay travel demand:

- **ALTERNATIVE 1** — Highway Operational Improvements With HOV Lanes and Express Bus Service Expansion (all corridors)
- **ALTERNATIVE 2** — New Oakland-San Francisco Rail Tunnel and BART Tube With New San Francisco BART Subway
- **ALTERNATIVE 3** — Expand Capacity of San Mateo-Hayward Bridge With Ultimate Widening to Eight Lanes (includes I-880 improvements)
- **ALTERNATIVE 4** — New Bay Crossing Connecting I-380 at U.S. 101 to I-238 at I-880 (six lanes)
- **ALTERNATIVE 5** — Rehabilitate Dumbarton Rail Bridge and Provide Corridor Rail Service
- **ALTERNATIVE 6** — Improve Dumbarton Bridge Approach Roadways (West Bay)

Evaluation

The detailed evaluation included analysis of the following factors.

- **Transportation Effects** — Given the longer-term nature of many of the proposed improvements, the analysis focused on travel conditions in 2025. MTC staff was responsible for forecasting future travel

demand and travel behavior, including the level of transit and roadway use, changes in travel times for different travel modes, changes in accessibility to jobs, and the amount of delay reduction provided by various strategies. Results for each alternative were compared to those for the baseline alternative, described below. The baseline includes all projects in the *2001 Regional Transportation Plan (RTP)*, which is financially constrained to expected future revenue. The MTC model was further used to analyze various policy issues and their transportation effects, in a series of “sensitivity analysis.” Summary tables showing selected evaluation results for each alternative and the sensitivity test are included in Section 7, Technical Appendix. (See June 19, 2002 memo to Policy Committee for more information.)

- **Cost Analysis** — The initial cost analysis provided information on both the capital and operating costs of each of the transbay improvements evaluated. Capital costs include project delivery costs. Operating costs include both the total cost and net cost, which would represent the operating subsidy required after taking into account projected ridership and revenues. Cost ranges were developed for a number of alternatives, reflecting uncertainties at this level of design. The alternatives were evaluated for cost-effectiveness based on a ratio of annual travel-time savings to annualized cost.
- **Environmental and Socioeconomic Issues** — The initial evaluation included a general reconnaissance of potentially significant issues associated with each alternative, including
 - Land use
 - Wetlands
 - Noise and vibration
 - Water quality
 - Air quality
 - Visual
 - Access to jobs from disadvantaged communities.

Baseline Alternative

The six study alternatives build from and were compared to the baseline alternative. The baseline assumes the investments currently contemplated in the *2001 Regional Transportation Plan*. Those investments with the potential to help transbay travelers are listed below:

- Bay Bridge West Span Seismic Upgrade and New East Span
- Bay Bridge Regional Express Bus Service
- Improved BART Headways in Transbay Tube
- San Mateo-Hayward Bridge Causeway Widening, HOV-Lane Extension, I-880 Interchange Improvements
- Bayfront Expressway Widening (Route 84)
- Route 92 Improvements (U.S. 101 to Route 1)
- Caltrain Service Upgrades and Electrification
- Transbay Terminal Replacement and Downtown Caltrain Extension
- BART to San Francisco International Airport and BART to San Jose.

Public Opinion

Stakeholders and focus groups (but not public meeting participants) were asked their view of the consequences of not making additional transportation improvements in the transbay corridors. Specifically, they were asked: “What are the consequences on the Bay Area of not adopting any of the packages described in this study (i.e., accepting the current transbay infrastructure as a given for the next several decades)?”

Most responded with some version of “total gridlock” and “severe loss of mobility.” Some cited a reduced quality of life, lower worker productivity, a much-weakened economy, and outflow of investment, jobs and housing from the urban core to outlying areas. A loss of credibility for government institutions also was mentioned as a negative consequence. Many mentioned land-use decisions as both the cause and part of the solution for transportation problems, and that better land-use planning, including better jobs/housing balance, is needed, regardless of what transbay infrastructure may ultimately be built. (See page 53 for discussion of land-use sensitivity analysis.)

A negative view of not making further investments in the transbay corridors was held by most, but not all, participants. Some said that the projected degree of growth in jobs and population is simply not acceptable and will not happen. Others said that people would just make different lifestyle and travel choices to accommodate a lack of infrastructure, so the future would not be so dire.

1 Highway Operational Improvements With HOV Lanes and Express Bus Service Expansion

Description

Alternative 1 includes a range of operational improvements to existing crossings, including:

- HOV lanes and spot operational traffic improvements on bridge approaches
- Toll plaza modifications, primarily FasTrak™ electronic toll collection enhancements
- Incremental expansion of transbay BART service
- New and expanded express bus service in all three bridge corridors, with park-and-ride lots.

The specific improvements for each bridge corridor are shown in Figure 13, page 33.

Transportation Effects

The principal transportation findings of Alternative 1 include:

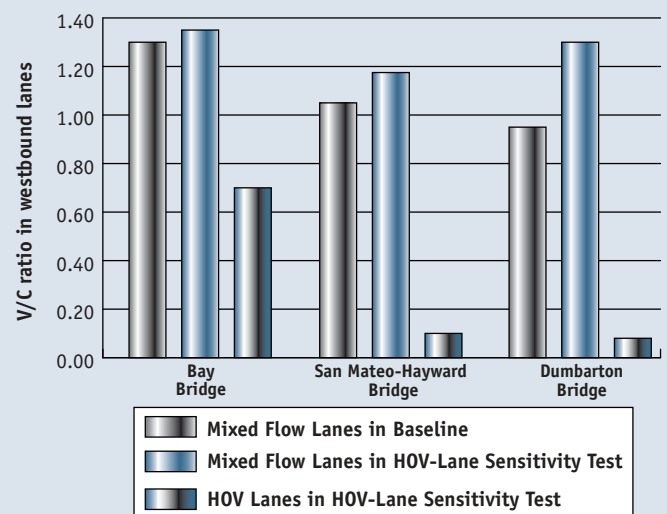
- The biggest shift in travel that would occur under Alternative 1 would be an increase in 2025 express bus ridership from about 21,000 riders in the baseline to about 52,000. In the Bay Bridge corridor, new and expanded express bus service would increase daily ridership from 19,800 to 43,400, though many of those riders would be switching from BART. In the San Mateo-Hayward Bridge corridor, where no bus service was assumed in the baseline, new express bus service would generate 6,200 daily riders. In the Dumbarton Bridge corridor, expanded express bus service would increase daily ridership from 1,300 to 2,200.
- Express bus service expansion will benefit from existing and proposed HOV-lane extensions included in Alternative 1 — notable examples in the Bay Bridge corridor include HOV-lane extensions on I-880 south, I-580 east, MacArthur Boulevard and Grand Avenue.
- Travel forecasts for Alternative 1 do not indicate significant change in carpool levels with express bus and FasTrak™ improvements offering competitive travel times. Carpool users in the Bay Bridge corridor would receive the greatest benefits under Alternative 1, with travel time savings of five to 10 minutes at the Bay Bridge approaches in the East Bay and in San Francisco.

- Those using the San Mateo-Hayward and Dumbarton bridges would experience significant decreases in delay at the toll plaza.

Sensitivity Analysis

Alternative 1 was tested in conjunction with increasing the vehicle-occupancy requirements from two to three persons on all bridges and all HOV lanes on I-880 and U.S. 101 that connect to the bridges. In addition, one lane in each direction on the bridges would be converted to an HOV lane. This test showed a deleterious effect on bridge operations since the HOV lanes on the bridges would not be fully filled with carpools and buses, resulting in overcrowding in the adjacent mixed-flow lanes, particularly on the San Mateo-Hayward and Dumbarton bridges. (See Figure 12, below.)

Figure 12: A.M. Peak Period Volume-to-Capacity (V/C) Ratios on Bridges



Cost

The total cost of Alternative 1 is estimated at \$684 million in capital plus an additional \$532 million in net annual operating and maintenance cost over a 20-year period. Although the total capital cost of Alternative 1 is substantial, it includes 14 “low cost” HOV/operational projects that could be implemented for about \$60 million, and the purchase of express buses and construction of park-and-ride lots for \$160 million. Higher-cost portions of Alternative 1 include three addi-

The Bay Crossings Study

Alternatives at a Glance

Alternative #2
BART and/or Heavy Rail Tunnels

Transportation Impacts

- 30,000 new daily transit riders*

Environmental Issues

- Disposal of contaminated soils as a result of tunnel and station excavation, especially in San Francisco

**Does not include potential high-speed rail riders*

Alternative #4
New Mid-Bay Bridge

Transportation Impacts

- Decreases delay on all three existing bridges, and on U.S. 101 south of SFO and Route 92 west of U.S. 101

Environmental Issues

- Displacement of residences and commercial properties in the East Bay
- Water quality and aquatic habitat
- Visual impact

Alternative #6
Dumbarton Bridge Approach Roadways

Transportation Impacts

- More balanced distribution of traffic on local roadways
- Peak-period delays on University Avenue, Willow Road and Bayfront Expressway reduced by more than 50 percent.

Environmental Issues

- Wetlands impacts
- Special status species
- Visual impact

Alternative #3
Expansion of San Mateo-Hayward Bridge Capacity

Transportation Impacts

- Phase I provides a low-cost way of addressing peak-direction capacity needs through 2015.
- Phase II provides adequate capacity in both directions through 2025.

Environmental Issues

- Water quality
- Aquatic habitat
- Displacement of residences near I-880

Alternative #1
Operational Improvements/ Express Bus/Carpool Lanes (not mapped)

Transportation Impacts

- 41 percent increase (over baseline) in Bay Bridge bus ridership
- Reduced toll plaza delays on Dumbarton and San Mateo-Hayward bridges

Environmental Impacts

- Localized impacts during construction

Alternative #5
Dumbarton Rail Service

Commuter train service on a rehabilitated Dumbarton rail bridge from Union City to Millbrae and Union City to San Jose (basic service). Allows connections with ACE, Capitol Corridor and Caltrain. Potential expanded service from Tracy or Milpitas. Track and alignment improvements in the East Bay. Seismic upgrade probably required.

Transportation Impacts

- 3,000–6,000 daily riders
- Three trains per peak hour (basic service) to six trains per peak hour (expanded service) across rehabilitated bridge
- Limited impact on Dumbarton Bridge traffic

Environmental Issues

- Local noise and vibration from operations
- Water quality
- Aquatic habitat
- Wetlands impacts

tional HOV-lane projects for \$240 million, and \$220 million for 47 higher capacity BART cars, which could be operated in conjunction with an upgrade of most of the transbay fleet to three-door-car service.

Cost-Effectiveness

Alternative 1 is the second most cost-effective of the study alternatives. Travel-time savings per million dollars invested ranges from 60,000 hours for all of the improvements to 80,000 hours for the lower-cost improvements and expanded bus service.

Environmental and Socioeconomic Impact

The environmental impacts associated with the 14 low-cost HOV-lane and operational options are expected to be minor and generally insignificant; however, there could be substantial impacts associated with the three remaining “high-cost” HOV-lane projects.

Public Opinion

Responses from the second round of public outreach efforts suggest that Alternative 1 is generally viewed as a stopgap, near-term alternative that could be implemented without much controversy. There also is doubt about its ability to address the long-term problems. Participants in focus groups and public meetings felt a positive aspect is that the alternative could be deployed in all three transbay corridors relatively quickly and has the flexibility to serve the dispersed land-use pattern. A negative aspect is public resistance to buses as compared to driving alone or using rail transit. When asked to consider costs, stakeholders, focus group members,

and public meeting participants ranked Alternative 1 first or second overall. Poll respondents, who showed no strong preference for any one alternative, ranked Alternative 1 in the middle of the pack.

Synopsis of Findings

Alternative 1 provides a synergistic blend of low-cost HOV-lane and traffic operational improvements and expanded express bus services in all of the Bay crossing corridors. These services can be readily adopted in phases: Individual HOV lanes, traffic operational improvements and park-and-ride facilities can be developed as separate projects, and express buses can be added from year to year as transit demand increases. Alternative 1 provides a cost-effective solution for transbay mobility needs.

The three high-cost HOV-lane projects (see Figure 13) have merit, but should be studied further to refine the proposed engineering requirements, obtain more detailed cost information, and identify and address potential environmental impacts associated with these projects.

The BART three-door car purchase is a costly provision of Alternative 1. However, in the event BART ridership obtains the levels projected for 2025, the investment in three-door cars for faster loading and unloading would be a relatively low-cost solution compared to other alternatives under consideration such as the new BART tunnel studied in Alternative 2. Further study is needed to refine our understanding of BART transbay capacity constraints and needs.

Figure 13: Specific Improvements in Alternative 1

HOV-lane/operational improvements — lower-cost improvements (all in Bay Bridge corridor)

- Westbound Grand Avenue on-ramp HOV-lane extension (Oakland)
- Westbound I-580 approach left-side HOV-lane extension (Oakland)
- Westbound I-80 HOV-lane approach improvement — install a barrier to separate HOV lane from the mixed-flow lanes from the flyover structure to the toll plaza metering lights (Oakland)
- Westbound approach to Maritime off-ramp — extend approach to allow trucks exiting at Maritime to leave the Bay Bridge toll plaza queue earlier (Oakland)
- Westbound toll plaza modifications to isolate left-side HOV lanes west of toll plaza
- Northbound I-880 HOV-lane approach extension to Adeline Street (Oakland)
- HOV-lane improvements to Essex Street ramp — convert right lane to HOV lane (San Francisco)
- Extension of 2nd Street HOV lane eastward toward King Street (San Francisco)
- Extension of HOV lane on Bryant and Beale streets (San Francisco)
- Casual carpool restrictions and carpool unloading zones (San Francisco)
- Redesign of Sterling Street on-ramp with improved signage (San Francisco)

HOV-lane/operational improvements — high-cost improvements

- Bay Bridge — new westbound right-side HOV-lane approach/structure alongside I-580 (Oakland)
- San Mateo-Hayward Bridge — close HOV-lane gap on Route 92 from Hesperian Boulevard to I-880
- Dumbarton Bridge — Route 84/I-880 interchange direct HOV-lane flyovers

Toll plaza improvements — lower-cost improvements

- San Mateo-Hayward Bridge — provide FasTrak™ approach lane
- Dumbarton Bridge — provide FasTrak™ approach lane

BART

- Incremental expansion of transbay service from 27 to 30 trains per hour as a result of purchasing three-door cars that allow faster loading and unloading of passengers at downtown San Francisco stations

Express Bus

- Bay Bridge — upgrade peak-hour bus trips from 96 to 158 by increasing the frequency of existing AC Transit transbay routes and adding new express bus service from central Contra Costa County locations (Walnut Creek and Moraga)
- San Mateo-Hayward Bridge — restart bus service for a total of 10 peak-hour trips. (No bus service is assumed in the baseline.) Routes would run from the Bay Fair BART station to Redwood Shores, Foster City and San Francisco International Airport, with new park-and-ride facilities providing up to 3,000 spaces along Route 92 west of I-880.
- Dumbarton Bridge — upgrade peak-hour service from four to 10 trips by increasing frequency on existing Dumbarton Express bus routes and adding a new route to Mountain View/Sunnyvale. New park-and-ride facilities would be constructed with up to 3,000 spaces in the East Bay.

2 New Oakland-San Francisco Rail Tunnel and BART Tube With New San Francisco BART Subway

Description

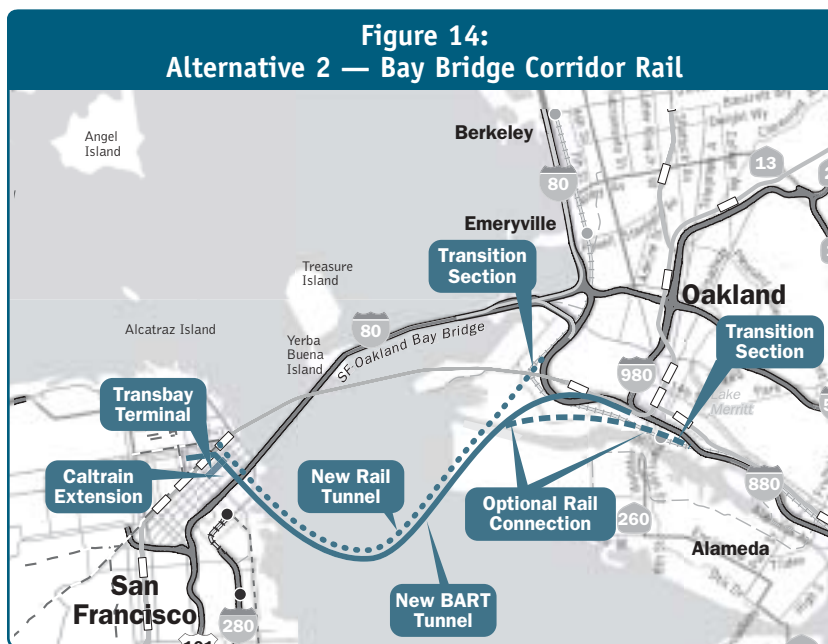
This alternative considers a southern alignment for a BART and/or conventional/high-speed rail tunnel that would enter San Francisco along Main or Beale Street. Such a tunnel would be constructed as a “bored tunnel,” thereby resulting in substantial cost savings compared to the “sunken tube” method used to construct the existing transbay tube. In addition, a deep, bored tunnel would avoid the negative environmental impacts that would otherwise result from the disturbance of Bay sediments in a re-grading operation needed to provide a bed for a sunken tube. As a bored tunnel, the alignment would sweep to the south of the existing transbay BART tube in order to take advantage of the shallower Bay floor in that area, and would enter San Francisco in a north/south configuration so that it could climb to shallow subway depth approaching the Transbay Terminal. While longer in distance, this alignment is lower in cost than one that would require tunneling deeper in the Bay floor. Figure 14 shows the alignment of the new tunnel.

The BART tunnel would connect to the existing BART system immediately west of the existing Oakland “wye” and would include an extension, with the ability to run trains from Richmond, the Pittsburg/Bay Point line and the Fremont and Dublin/Pleasanton lines to either the existing transbay tube (via West Oakland) or

to San Francisco in the new tunnel (via a new Jack London Square station near Clay Street in Oakland). There would be three new stations in San Francisco: Transbay Terminal, Market Street (transfer station to the existing Powell Street station) and Union Square.

The rail tunnel would be electrified and capable of operation with electric (or dual-power) locomotives and conventional coaches, multiple-unit electric trains, or future high-speed rail equipment. The rail line would connect to the Caltrain extension at the Transbay Terminal, and would have a wye in the East Bay, with one leg connecting toward Emeryville (for service between San Francisco and Fairfield) and a separate south leg connecting to the existing Capitol's rail line near Jack London Square, with a station along the Embarcadero near Clay Street (for service between San Francisco and Milpitas).

Other concepts that were considered as variations include: 1) a BART “breakout” track from the existing underwater BART tube near San Francisco along Market or Howard streets to provide additional station access in downtown San Francisco without constructing an entirely new transbay tube, and 2) a scaled-down connection on the East Bay side of the conventional rail tunnel, basically only providing a connection to the north and not the south.



Transportation Effects

Alternative 2 would result in the highest level of total transit ridership in the Bay Bridge corridor. The alternative would generate nearly 310,000 daily transbay transit trips in this corridor, equivalent to a 39 percent transit mode share. This is a significant increase in transit use compared to the baseline figure of 280,000 daily transbay transit trips, which represents a 36 percent mode share. The associated reduction in auto traffic (about 5,000 vehicles daily) is marginal and would not result in any perceptible reduction in peak-period congestion.

The new rail line with both northern and southern connections would attract 16,000 daily transbay trips and the new BART tunnel and stations would attract 269,000 daily transbay BART trips. If the rail tunnel were constructed with a northern connection only, to reduce costs, daily transbay ridership is projected to be 12,000. If a future high-speed rail system were to use the rail tunnel in 2025, 4,800 additional daily riders could travel through the tube en route between Sacramento and San Francisco and the northern Peninsula.

About two-thirds of BART transbay ridership (about 170,000 daily riders) would remain on trains using the existing transbay tube. The remaining one-third (about 96,000 daily riders) would travel to the three new San Francisco stations served by the new tube.

The potential travel-time savings for rail and BART passengers in Alternative 2 are modest in many cases (less than five minutes). The most significant travel-time gains (up to 20 minutes) are for people traveling to the South of Market area in San Francisco from locations near the Capitol Corridor rail line in the East Bay.

Although the net increase in BART ridership is modest (16,000 daily riders), Alternative 2 would reduce crowding on BART trains, provide more convenient access to additional San Francisco and Oakland destinations, and provide capacity for future growth in ridership. In addition, the new tube would add redundancy to the BART system, which could be critical in the event of an incident, such as a major earthquake, that would disrupt service in the existing tube.

Cost

The capital cost of the BART tube, including the new Jack London station, the 2-mile-long San Francisco subway and three new San Francisco subway stations, is estimated to be \$7.1 billion to \$10.3 billion. Over a 20-year period, the net operating and maintenance cost would add another \$1.1 billion.

The cost of the conventional/high-speed, electrified rail tunnel, including a new underground station at

Jack London Square, is estimated at \$7.5 billion to \$11.8 billion. Over a 20-year period, the net operating and maintenance cost would add another \$220 million. Elimination of the south leg of the Oakland wye, including the new Jack London Square area station at Clay Street, would save \$3.1 billion to \$3.8 billion in capital cost and a small amount in operational cost.

The rail tunnel alternative assumes that Caltrain would be extended to the Transbay Terminal in San Francisco and that trains using the rail tunnel would be able to stop at a new station at the Transbay Terminal. These improvements, which are being evaluated in separate studies, have not been included in the cost estimate.

Additionally, rail locomotives would need to operate under electric power in the rail tunnel. Dual-mode motive power (electric or diesel-electric) would be required or extensive portions of the East Bay and Peninsula rail networks would need to be electrified. These additional systemwide costs have not been evaluated as part of this study.

Cost-Effectiveness

Alternative 2 was the alternative that scored lowest in the cost-effectiveness evaluation. The BART and rail tunnels, which were considered separately, each offered 5,000-7,000 annual hours of travel-time savings per million dollars of annualized cost.

Environmental and Socioeconomic Impact

This alternative has a number of potential impacts:

- Land-Use Impacts — Primarily at East Bay light industrial areas affected by stations, portal transition sections and aerial guideway. Station construction may cause impacts in San Francisco and Oakland.
- Disposal of Excavated Soils — About 2.6 million yards of tunnel excavation would result, some of which (coming from areas in the vicinity of portals and station construction) may be contaminated.
- Water Quality Impacts on Construction
- Construction Noise and Vibration — Especially for at- and above-grade construction
- Air Quality — Dust and construction emissions
- Disadvantaged Communities — Improved access to jobs.

Public Opinion

Public outreach efforts show that there is general agreement that this alternative addresses the majority of the corridor congestion. Rail, whether BART or conventional rail, is generally considered the most attractive transit option; however, some participants expressed hesitation in respect to the cost of the alternative. Respondents to the second poll preferred BART to conventional rail 54 percent to 20 percent; other outreach participants were split about evenly.

More poll respondents preferred Alternative 2 than any other alternative, but only 23 percent selected it as their preferred alternative. Results were more mixed for other outreach participants, with participants in the public meeting ranking it last overall, and stakeholders and focus group participants ranking it in the middle.

The alternative was recognized as providing more capacity, comfort and reliability for BART. The success of the commuter rail tunnel was recognized to depend on good connections in the East Bay and perhaps the advent of high-speed rail to use the crossing. The high cost and potentially modest increase in rail ridership projected for either BART or conventional rail (related to the fact that the systems basically improve service in existing market sheds rather than tapping into new travel markets) may make it difficult to implement.

Synopsis of Findings

The Alternative 2 improvements include some of the highest capital cost solutions proposed to address transbay travel markets, ranging from a low of \$4.4 billion for a reduced-scope commuter rail tunnel serving the San Francisco to Emeryville stretch to a high of \$12 billion for the new BART tunnel that includes a new

San Francisco subway with three new city stations and a fourth new station near Jack London Square in Oakland. As such, these options should be evaluated in comparison to other high capital cost improvements such as a new mid-Bay bridge (Alternative 4) or the full widening of the existing San Mateo-Hayward Bridge (Alternative 3, Phase 2) with respect to the time frame needed for implementation and for assembling funding.

Given that BART has adequate capacity to handle the projected transit demand under the baseline scenario and that incremental improvements in Alternative 1 effectively add capacity, construction of a new BART tunnel and San Francisco subway and stations would serve to address other objectives, such as reduced peak-period crowding, increased reliability, and greater transit service coverage.

The electrified commuter rail/high-speed rail tunnel, if built with the northern connection only (San Francisco to Emeryville), would be substantially lower in cost at \$4 billion to \$8 billion, but would not be as effective at attracting new transit riders. This facility could potentially become a link in future high-speed rail service between San Francisco and Sacramento, serving up to 4,000 daily riders from locations beyond the MTC travel shed. Planning initiatives already are under way to consider establishment of commuter rail service along the Capitol Corridor route between Oakland and Sacramento. Eventual development of more frequent commuter rail service and expansion of the existing service provided by the Capitols, including non-transbay trackage improvements and electrification, would logically have priority over construction of a costly Oakland-to-San Francisco rail link.

Expand Capacity of San Mateo-Hayward Bridge With Ultimate Widening

Description

This alternative includes two phases:

Phase I would install reversible lanes on the high-rise portion of the bridge. The existing median barrier on the high bridge section would be removed and replaced with a movable barrier. The movable barrier would be operated to provide four lanes in the peak direction and two lanes in the reverse peak direction. Three lanes would be provided in each direction during other times. Both causeway bridges would have to be restriped to provide four lanes, with an outside shoulder maintained for disabled vehicles. Additional study is needed to refine engineering needs and costs and to determine the feasibility of using the reversible lane for carpools and buses.

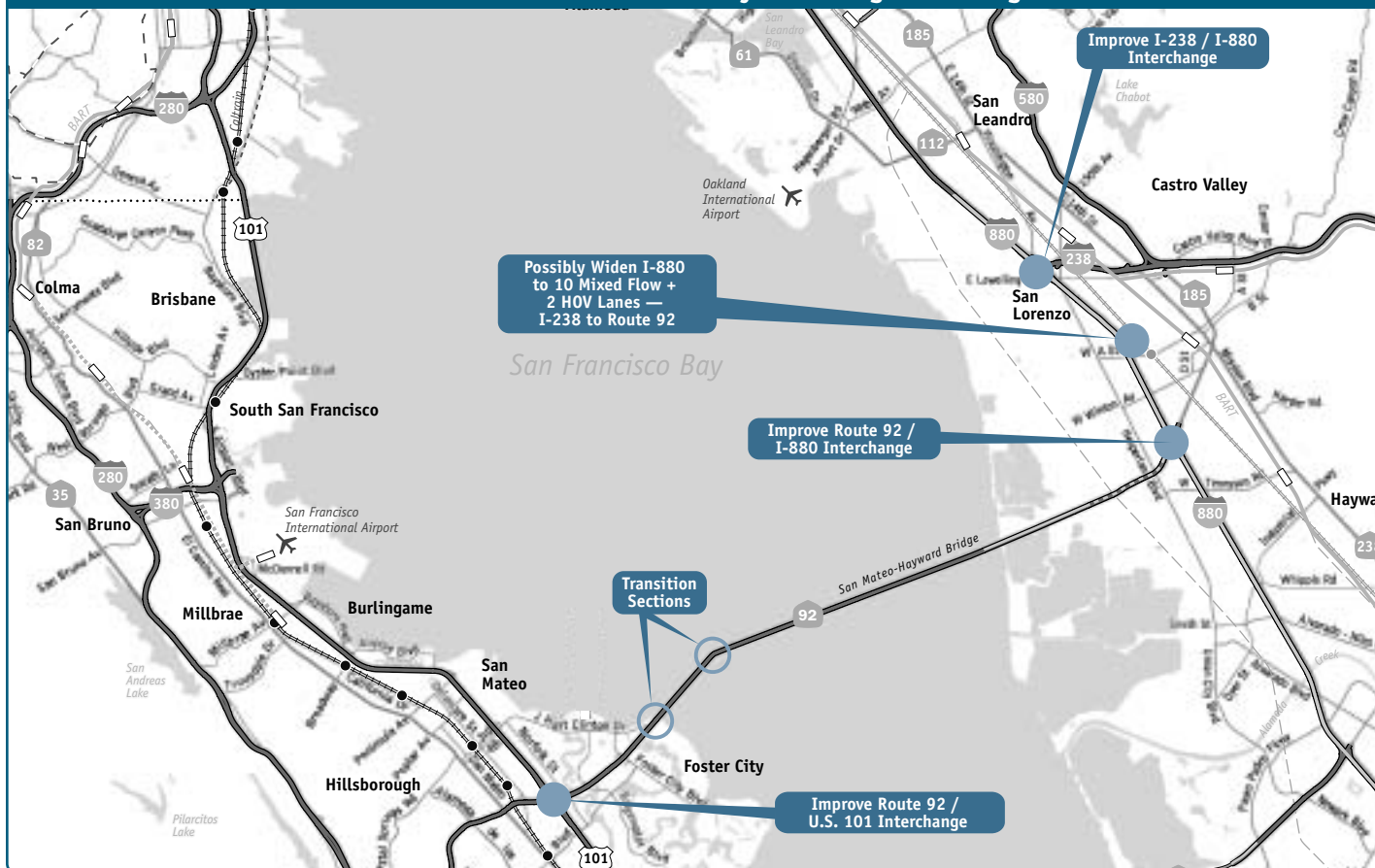
Phase II would widen the high bridge to provide four lanes in each direction at all times, restore full inside and outside shoulders, and develop a continuous

bike path across the entire facility. The second phase may require additional improvements on I-880 between Route 92 and I-238. Therefore, to be conservative on the cost side, the alternative includes: one additional lane in each direction for a total of 10 mixed-flow lanes plus two HOV lanes on I-880; improvements to the interchange at I-880/Route 92 between I-880 north and Route 92 west, with possible direct HOV-lane connectors; and a new auxiliary lane for better flow on the existing two-lane ramp from westbound I-238 to southbound I-880. The need for this aspect of the project should be carefully reviewed in further studies. The Phase II elements are shown in Figure 15.

Transportation Effects

Improvements currently under way will provide three continuous lanes in each direction across the entire San Mateo-Hayward Bridge. Travel forecasts indicate that the six-lane bridge would be “at capacity” in

**Figure 15:
Alternative 3 — San Mateo-Hayward Bridge Widening**



**Figure 16 — Improve San Mateo-Hayward Bridge
Level of Service Impacts**

Scenario	Existing Bridge	Baseline Improvements			Phase I		Phase II
Year	2000	2010	2015	2025	2010	2015	2025
Peak Direction (westbound a.m.)	F	D/E	E/F	F	B	C	D/E
Reverse-Peak Direction (eastbound a.m.)	B	A/B	B	C/D	D/E	E/F	B

Service Level "A" is the best and "F" is the worst, indicating extensive congestion and delays.

the peak direction during the a.m. and p.m. peak demand periods by 2025 as shown in Figure 16. Therefore, while the recent widening project will provide near-term relief, additional measures are desirable in the longer term.

The Phase I project would potentially address peak-direction capacity needs. In fact, by providing four peak-direction lanes, the Phase I project would have adequate capacity to accommodate 2025 demands. However, the reduction in reverse-peak capacity from three lanes to two lanes (with the movable barrier) would result in the reverse-peak direction becoming over-capacity prior to 2025. (See Figure 16.)

The Phase II improvements would provide four through lanes in each direction and would be fully adequate to handle peak and reverse-peak flow through 2025. The a.m. peak volume-to-capacity (V/C) ratio would be 0.84, indicating good traffic conditions on the bridge. This improvement would be needed by about 2015 if the Phase I project were implemented.

While Alternative 3 is effective in reducing congestion on the San Mateo-Hayward Bridge, it would not have a significant effect on the other bridges. Alternative 3 would not result in any significant change in regional freeway V/C ratios or delay except on I-238 between I-580 east of I-880, where a.m. peak-period delay would increase from 190 to 230 vehicle hours.

The number of persons using carpools daily on the San Mateo-Hayward Bridge would increase by 22 percent, an increase of 8,000 daily person-trips.

Costs

The capital cost for the Phase I movable barrier is estimated to be \$40 million. There would be an additional operating cost for the personnel required to move the barrier four times per day. Twenty years of operating costs would add \$13 million to this estimate. These costs will be reviewed in a more detailed study.

The capital cost of widening the San Mateo-Hayward Bridge to eight lanes (Phase II) would be \$1.8 billion to \$2.4 billion for the bridge itself plus \$190 million for widening I-880, if this proves to be a requirement for widening the bridge. Twenty years of operating and maintenance cost would add \$52 million.

Cost-Effectiveness

Alternative 3 (Phase II) offers 35,000-39,000 annual hours of travel-time saved per million dollars in annualized cost. This placed it in the middle among the six alternatives.

Environmental and Socioeconomic Impact

Potential impacts of the Phase II improvements include:

- Displacement of Homes in Hayward — Due to I-880 widening (350 to 400 lots)
- Water Quality and Aquatic Habitat — Due to pier constructions

- Visual Impacts of Wider Structure
- Construction May Affect Special-Status Species
- Water Quality Impacts of Construction
- Noise and Vibration During Construction
- Air Quality — Dust and construction emissions
- Disadvantaged Communities — Improved access to jobs.

Public Opinion

Alternative 3 engendered the most tepid comment. In general, outreach participants felt it did not address the major transbay mobility problems. Focus group and public meeting participants, who tended to favor transit solutions, ranked it near the bottom when prioritizing solutions. However, many felt the widening was a better, less disruptive approach than constructing a new bridge. Poll respondents preferred the San Mateo-Hayward Bridge widening to constructing a new bridge by 61 percent to 25 percent. Focus group and public meeting participants expressed concern about the impacts to connecting highways in the East and West Bay. Participants at the May 2002 meeting in San Leandro expressed particular concern about the impact on East Bay neighborhoods.

Synopsis of Findings

The ongoing widening of the bridge to six continuous lanes and extension of the HOV lane approaching the toll plaza to Hesperian Boulevard in Hayward will result in adequate capacity as well as advantageous conditions for express bus services and carpools in the near term.

Over the longer term, the substantial increase in demand projected for this facility would result in over-capacity conditions. The Phase I reversible-lanes project could potentially address peak-period capacity shortfalls in the peak-flow direction (westbound a.m./eastbound p.m.) at a very modest capital cost of \$40 million. However, the Phase I improvement would provide only two lanes in the reverse-peak flow direction, which would not provide enough capacity to meet 2025 reverse-peak demand. Therefore, the Phase I improvement has an expected useful life from some time after 2005 to about 2015.

The long-term capacity needs in this corridor could be met by Phase II. The total capital cost of this improvement (bridge and I-880 widening and related interchange improvements, if needed) is estimated at \$2.1 billion to \$2.4 billion.

There could be substantial impacts associated with this alternative, including the loss of up to 400 homes along the I-880 corridor between I-238 and Route 92. Travel benefits associated with Phase II of Alternative 3 are significantly less than those associated with Alternative 4.

4 New Bay Crossing Connecting I-380 at U.S. 101 to I-238 at I-880

Description

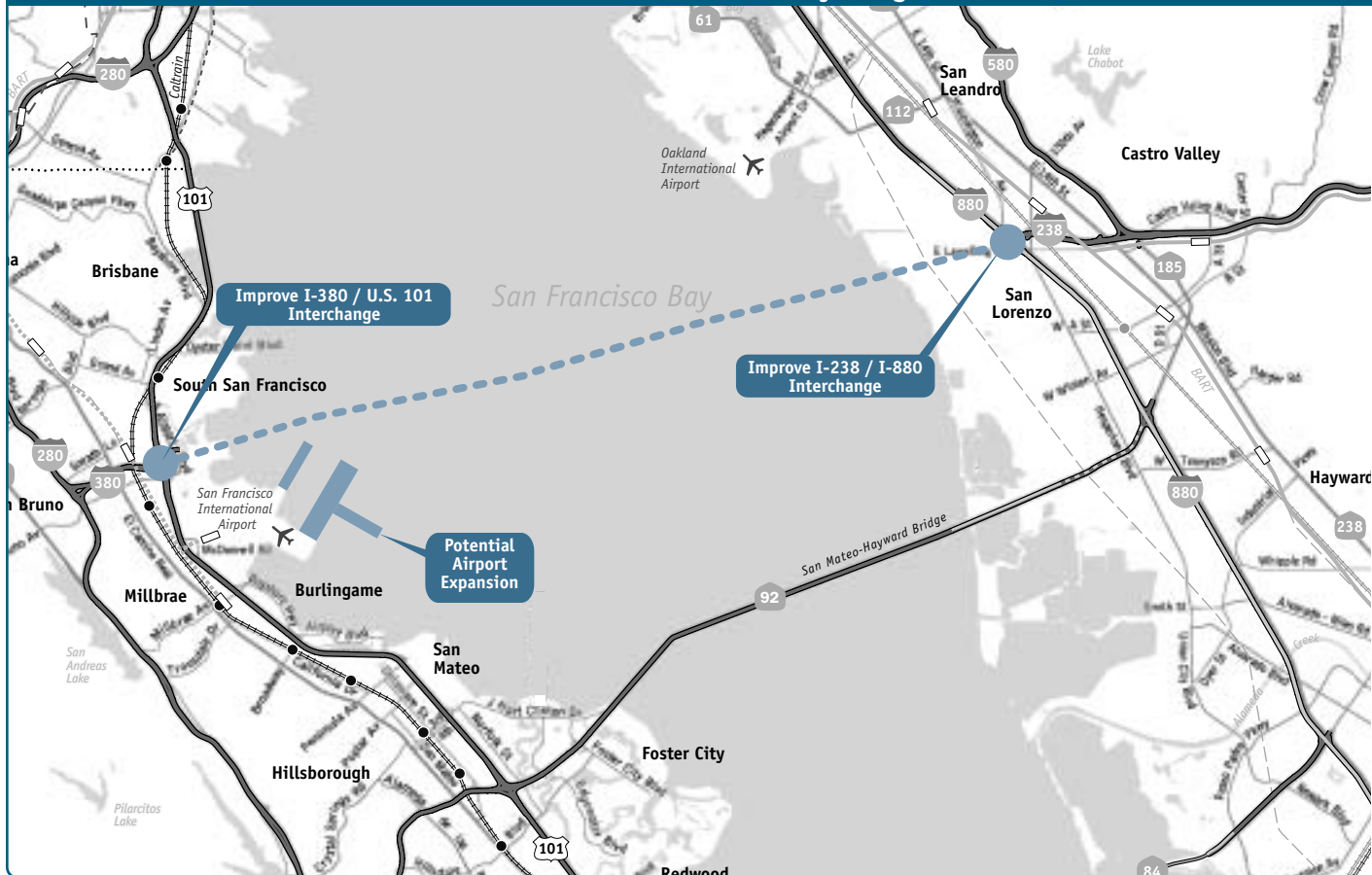
The alignment, shown in Figure 17, would connect to the east stub of the existing U.S. 101/I-380 interchange. The existing ramps serving South Airport Drive would remain and a new local roadway interchange on the new alignment would provide additional access to the public roadway system at San Francisco International Airport (SFO).

The horizontal alignment of the facility would be dictated by the vertical constraints on the West Bay side, which include the need to stay beneath the Federal Aviation Administration-mandated vertical airspace clearance zone around SFO as well as the need to clear the ship channel with a high bridge structure similar to the San Mateo-Hayward Bridge. As a result, the high bridge section would be located along the channel at a point north and east of SFO where a 300-foot vertical

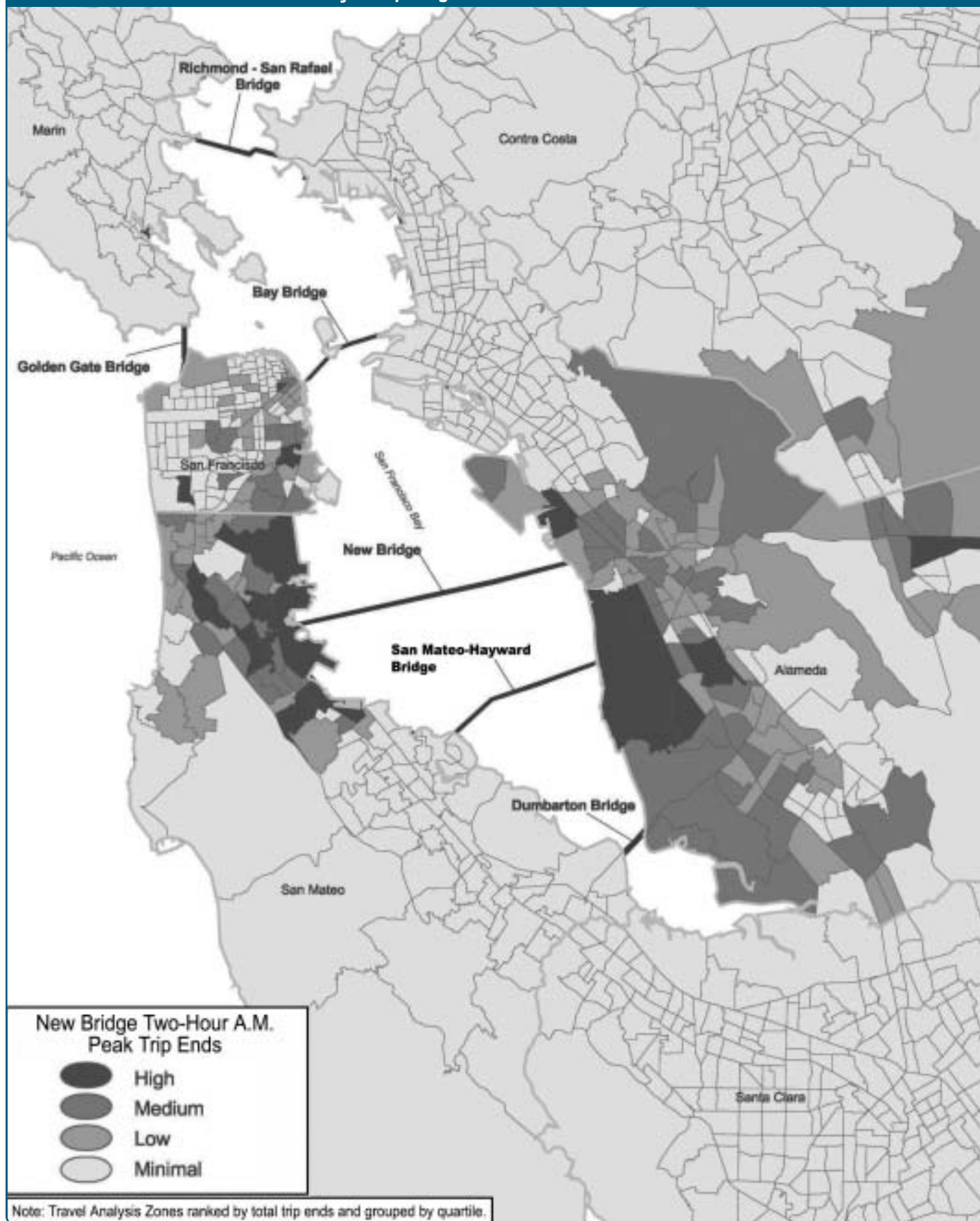
clearance is available. In order to cross the channel at this point, the alignment would sweep to the northeast of the U.S. 101/I-380 interchange where the connection would be made.

In the East Bay, the facility would be split into two sections that would be constructed at-grade along the top of an existing San Leandro Creek channel located along the boundary of San Leandro and San Lorenzo. Further east, the twin roadways would dip below grade in a short, bored tunnel section, to pass beneath existing homes, emerging at a portal located north and east of the intersection of Washington Avenue and Lewelling Boulevard. A new half of a freeway-to-freeway interchange would be constructed at the existing I-880/I-238 interchange to accommodate movements in all directions, including through-movement connections directly to I-238. The alternative assumes new express

Figure 17:
Alternative 4 — New Mid-Bay Bridge



**Figure 18: New Mid-Bay Crossing
Major Trip-Origin and -Destination Zones**



bus service from Hayward and San Leandro to SFO and Oyster Point. The alternative also assumes a bike path on the new bridge.

While there was considerable interest in the concept of a combined highway and rail bridge, two major drawbacks were evident. Building a combined rail/highway bridge would be about as expensive as building two separate rail and highway bridges. In addition, the rail system would not serve a particularly large transit market, resulting in low cost-effectiveness.

Transportation Effects

Alternative 4 accommodates the highest level of traffic across the Bay, with 713,000 daily vehicle-trips compared to 686,000 in the baseline. The alternative has the highest total number of daily transbay single-occupant-auto person-trips (645,000) and carpool person-trips (175,000). Not surprisingly, this alternative has the lowest level of total transbay transit use (266,000 daily person-trips).

It is the only alternative that significantly reduces the amount of traffic and delay on the existing bridges. The new bridge itself attracts 86,000 daily vehicle-trips, approximately half the level of traffic on the San Mateo-Hayward Bridge in the baseline. This alternative reduces daily traffic on the Bay Bridge by 23,000 vehicles and improves the peak-period level of service to E/F from F, indicating a slight decrease in congestion. The San Mateo-Hayward Bridge would benefit the most, with total daily vehicles decreasing from 160,000 in the baseline to 120,000 with the new bridge.

Based on an analysis that identifies the travel analysis zones with the highest number of trip ends associated with each facility, the prime West Bay market area for the new bridge is from the southernmost zones in San Francisco to the northern zones in San Mateo County, and the prime East Bay market area for the new bridge is East Oakland to Fremont, with some trip ends in the I-580 corridor towards Dublin. (See Figure 18.) The new bridge would cut 30 minutes of travel time between San Francisco International Airport and Hayward compared to the routing via the San Mateo-Hayward Bridge. Carpools and transit riders between these same two locations would save about 20 minutes. With the new bridge, some travelers from the vicinity of SFO in the West Bay and the vicinity of Oakland Airport in the East Bay would shift their trip from the Bay Bridge to the new bridge. Also, with the new bridge, some of the travelers from the vicinity of South San Francisco to Burlingame in the West Bay and from the vicinity of East Oakland to San Leandro/San Lorenzo in the East Bay would shift their trips from

the San Mateo-Hayward Bridge to the new bridge.

In order to evaluate the effect of the new bridge on regional freeways, the a.m. peak-hour, peak-direction volume-to-capacity ratios (V/C) were evaluated at 21 locations surrounding the Bay. "Significant" changes in congestion were identified at locations that would be congested ($V/C > .80$) in 2025 and that would experience a 3 percent or greater shift in V/C. On this basis, there were improvements at five locations and one adverse impact as noted below:

Improved

- I-380 between U.S. 101 and I-280 (.87 vs. .94 without new bridge)
- U.S. 101 between I-380 and Route 92 (.89 vs. .96)
- I-280 between I-380 and Route 92 (.83 vs. .87)
- I-580 between I-238 and I-880 (.94 vs. .97)
- Bay Bridge (1.10 vs. 1.25)
- San Mateo-Hayward Bridge (.86 vs. 1.03)

Degraded

- I-238 between I-880 and I-580 (.90 vs. .81 without new bridge)

Cost

The capital cost of the new bridge would be \$6.6 billion to \$8.2 billion. A significant proportion of the total cost would be incurred in the approach roadways, especially in the East Bay, where tunneling would be involved. Rail could be added to the new bridge, but at a cost of \$5 billion to \$6.5 billion or more, depending on the design and not including construction of new rail-to-rail connections on either end of the bridge. (Given the low transit ridership projected by the forecast model for this corridor, express bus service was identified as the most appropriate form of transit for the new bridge.)

Operating and maintenance costs for 20 years are estimated at more than \$500 million. By comparison, this cost is only 50 percent of the cost of the new BART tunnel in Alternative 2 and approximately equal to the net operational and maintenance cost of Alternative 1 (HOV/Express Bus).

Cost-Effectiveness

Alternative 4 offered 25,000-30,000 annual hours of travel savings per million dollars in annualized cost. This

placed it in the mid-range of cost-effectiveness among the six alternatives.

Environmental and Socioeconomic Impact

Potential impacts include:

- Land-Use and Right-of-Way Impacts — Impacts to shopping centers and apartments in the East Bay
- Tunneling Impacts — Impacts to residences and San Lorenzo Creek near portal and transition sections
- Water Quality and Aquatic Habitat — Due to pier construction
- Bay Fill at Toll Plaza and Peninsula Touchdown — Salt marsh (North Access Road) and wetlands (mouth of San Lorenzo Creek)
- Special Status Species — San Bruno and San Lorenzo Creek channels
- Construction Noise and Vibration
- Localized Air Quality Emissions During Construction
- Visual
- Disadvantaged Communities — Increased job accessibility.

Public Opinion

This was the most controversial alternative, with both the strongest advocates and the strongest detractors. Advocates view it as the only solution that makes a big difference in relieving Bay Bridge and San Mateo-Hayward Bridge congestion and serving the markets with the greatest needs. Its detractors see significant negative impacts on the environment, inducing more auto travel, increasing traffic on adjacent freeways, and harming the Bay ecology. Both opponents and supporters want more information on the possibility of putting a rail line on or near the new bridge.

Synopsis of Findings

Alternative 4 is the only alternative that adds substantial transbay highway capacity and is the only project that would significantly improve regional highway operations in the study area. Alternative 4 is the only alternative that would reduce congestion on the Bay Bridge, although the degree of relief would be marginal and the Bay Bridge would remain at capacity for more than four hours in the a.m. and p.m. for peak-direction flow. There would be a small number of localized negative traffic impacts with the new bridge that could potentially be mitigated with minor widening or addressed with freeway connector ramp-metering.

A new mid-Bay bridge would result in travel-time savings for trips between central Alameda County and northern San Mateo County of 20 to 30 minutes compared to routes over existing bridges.

The cost of Alternative 4, at \$6.6 billion to \$8.2 billion, makes it one of the higher-cost options. The addition of rail to the mid-Bay bridge corridor would add \$5 billion to \$6.5 billion to the cost, nearly doubling the cost of the facility. There also are significant issues with a rail line in terms of making operationally beneficial and cost-effective connections to existing rail lines on both sides of the Bay. Therefore, primary consideration was given to providing a network of express bus services between various East Bay locations and principal West Bay destinations such as downtown San Francisco as well as points north and south of San Francisco International Airport. However, the resulting demand of 1,600 daily riders was one of the lowest bus demands identified in the study.

There would be a wide range of environmental impacts associated with Alternative 4, including land-use displacement near the I-880/I-238 interchange and possibly at selected locations near transition sections. Bay fill would be involved for toll plaza construction and impacts to special status species could result. The cost of the displacement is reflected in the cost estimate, but additional costs would be incurred as a result of the environmental impacts. The new bridge would have a positive socioeconomic impact with respect to increasing job accessibility for disadvantaged communities.

Rehabilitate Dumbarton Rail Bridge and Provide Rail Service

Description

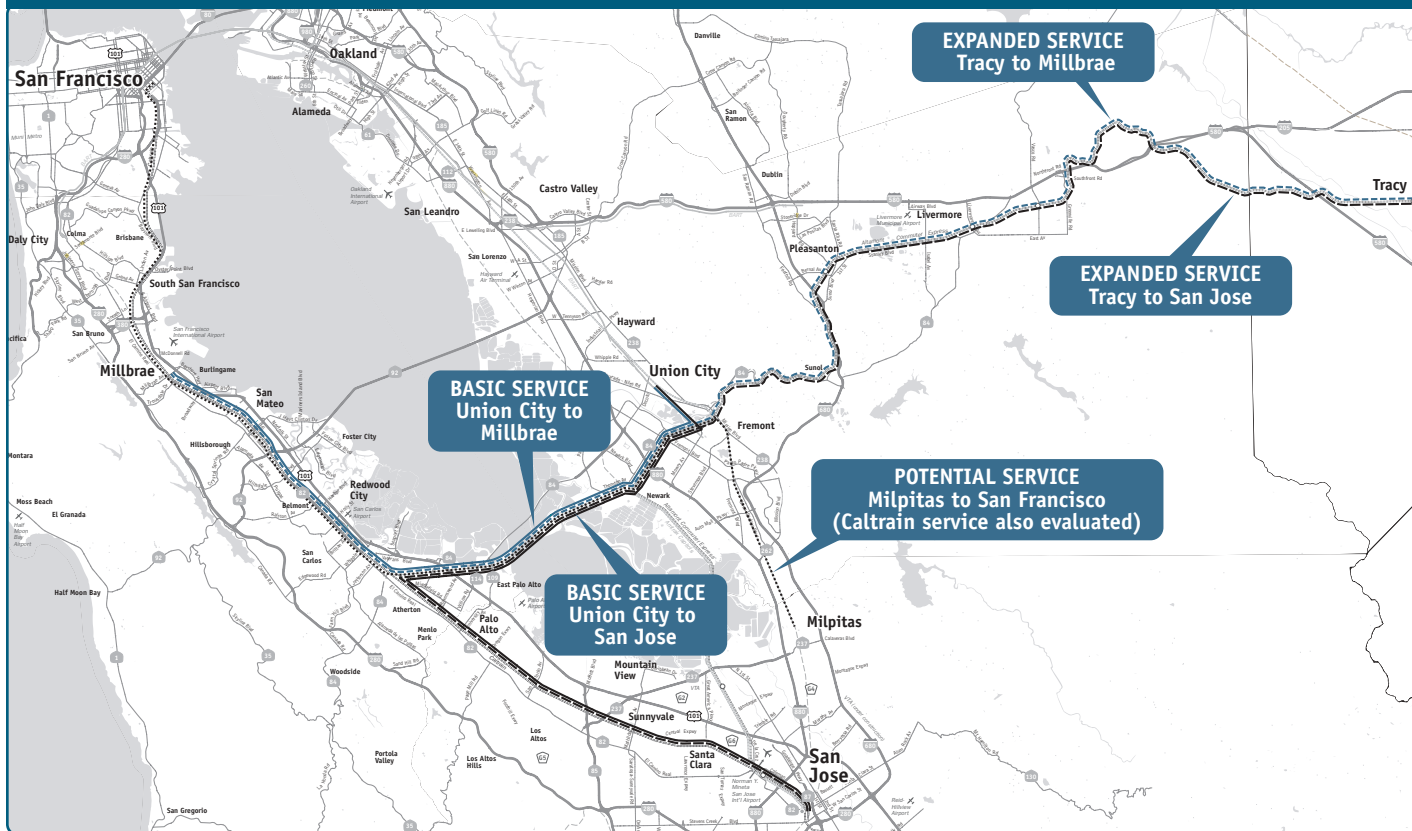
This alternative assumes that the Dumbarton rail bridge is rehabilitated and that new commuter rail service is initiated over the bridge. The rehabilitation portion is largely funded and included in the *2001 Regional Transportation Plan*. The main focus of this alternative was to identify the key track improvements necessary in the vicinity of the bridge to support new service and to study various service options. The basic service scenario (Phase I) assumes initiation of service between the Union City BART station and the Peninsula, with three peak-period trains to Millbrae and three peak-period trains to San Jose as identified in the current proposal by the Peninsula Joint Powers Board. In the expanded service scenario (Phase II), service between the Livermore area and the same two destinations on the Peninsula was considered. Expanded service would result in service across the bridge every 10 minutes. (See Figure 19.) A further service linking residents of Milpitas/Fremont to jobs on the Peninsula and at SFO was considered in additional forecasting.

Initiation of service would require replacement of

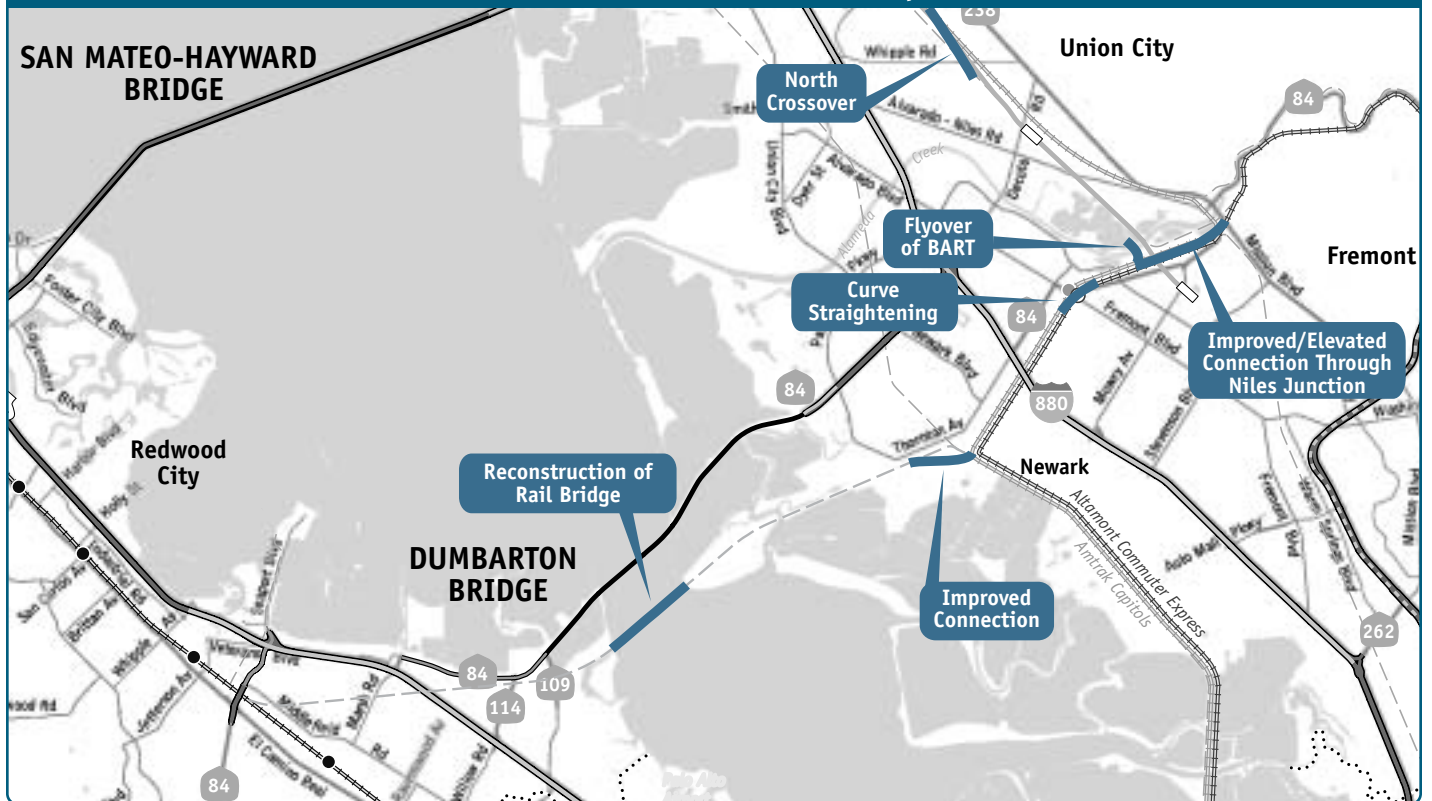
bridge sections damaged by fire as well as an upgrade or replacement of the remaining superstructure. A major consideration is seismic loading. Recent geologic studies have identified a high potential for soil liquefaction in the South Bay, and the existing footings may settle or fail in an earthquake. In addition to rehabilitating the bridge itself, the trackwork would need to be inspected and problem segments repaired and/or replaced along the existing trackage on the Peninsula and in the East Bay west of Newark Junction.

Finally, in order to operate the type of service plan identified in this study, additional track improvements are warranted to sections of the existing rail network in the East Bay. (See Figure 20.) Dumbarton passenger rail service would need to compete for track time and routing with freight service run by Union Pacific Railroad (UPRR), owner and operator of the East Bay lines, as well as the other two existing corridor rail services, the ACE service to Tracy and the Capitol Corridor service between Sacramento and San Jose. The cost of these latter improvements could be shared between all of the services that would benefit.

Figure 19:
Alternative 5 — Dumbarton Rail Service



**Figure 20:
Alternative 5 — Dumbarton Rail Track Improvements**



Transportation Effects

Phase I would attract 3,000 to 4,000 daily riders and Phase II would attract about 6,000 daily riders. (By comparison, the ACE service currently carries about 1,800 riders.) About 1,000 riders would be diverted from express bus services on the Dumbarton highway bridge.

There would be a very slight drop of fewer than 1,000 vehicles on the Dumbarton highway bridge with Alternative 5. There would be no significant regional impacts.

Cost

The bridge rehabilitation capital cost has been taken from previous studies and is estimated at \$130 million; an allowance of 30 percent has been added to this amount for unknown levels of seismic upgrade, resulting in an estimate of \$180 million to institute basic service. Of this, the original \$130 million is assumed to be funded in the *2001 Regional Transportation Plan*. No monies have been identified for operational costs, which are estimated at \$65 million over a 20-year period.

The cost of the expanded service plan, including additional track improvements and additional train sets, is about \$300 million. The net operational and maintenance cost of the expanded service is estimated at about \$280 million over a 20-year period.

Cost-Effectiveness

The evaluation showed this alternative to be highly cost-effective, with travel-time savings of 114,000 hours annually per million dollars of annualized cost.

Environmental Impact Issues

- Land-Use and Right-of-Way Impacts
- Water Quality and Aquatic Habitat
- Possible Fill Within Jurisdictional Wetlands — Salt marsh (east and west approaches), Alameda Creek Quarries Park
- Special Status Species — In the Bay, East Palo Alto/Dumbarton Point, Newark Slough, Alameda Creek, Alameda Creek Quarries Park
- Construction Noise and Vibration
- Visual
- Operational Impacts — Five at-grade crossings reactivated on the Peninsula.

Public Opinion

The Dumbarton Rail service was generally viewed and ranked quite favorably. Its low cost compared to other alternatives was noted, and it was seen as a service that could be put in place relatively quickly and provide a rail option for a congested corridor. For these reasons, stakeholders, focus groups and public meeting participants consistently ranked it as a top priority. There also was a general recognition that it will have only a small impact on the overall transbay travel market and that even its modest success will depend upon frequency of service, good connections with other services, such as other rail lines (Caltrain and ACE), and station parking. It would have no impact on relieving pressure on the significantly overloaded Bay Bridge corridor. Some environmental concerns regarding noise and neighborhood disruption were raised.

Synopsis of Findings

The Dumbarton rail project is already partially funded and has low capital and operating costs, resulting in a high benefit-cost ratio compared to other alternatives under consideration. The travel forecast indicates the alternative would be successful at attracting riders with both the Phase I as well as Phase II service plans. Although the alternative would not reduce traffic congestion, it would provide a new mobility option in the South Bay corridor.

A rehabilitated single-track rail bridge can support up to six trains per hour in one direction. The real benefit of the bridge is that multiple rail routes, tapping into new service areas, could use the bridge.

6 New Dumbarton Approach Road to the South

Description

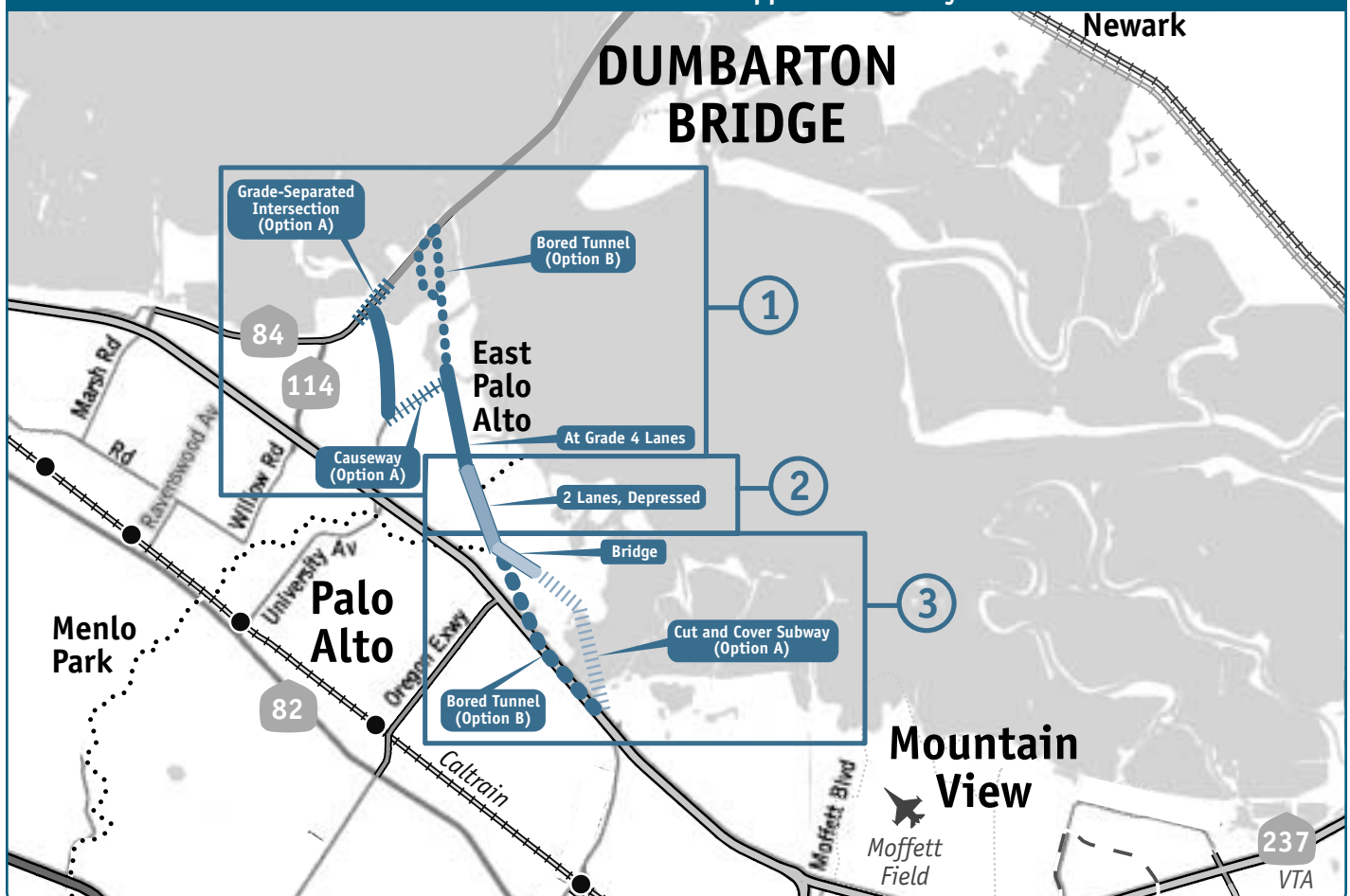
This alternative would address the approach road constraints that limit the use of the Dumbarton highway bridge by constructing a new West Bay southern access expressway complementary to the existing Bayfront Expressway, which provides access from the north. The new roadway is intended to provide alternatives for traffic that currently uses local arterial roadways in East Palo Alto, Palo Alto and Menlo Park to reach the bridge and reduce traffic impacts on local communities.

The facility would include three segments, as shown in Figure 21. The northern segment (1) would either be constructed as a bored tunnel connecting directly to Route 84 (Option B) or as a grade-separated intersection at Route 84/University Avenue, together with a causeway connecting University Avenue to the new bypass road described below (Option A). The central segment

(2) would be an at-grade roadway crossing through industrial lands and alongside residential bayfront lands in East Palo Alto. This segment would be two lanes, depressed. The southern segment (3) would use a bridge or a jacked tunnel at San Francisquito Creek, then either a cut-and-cover subway (Option A) or a bored tunnel (Option B) beneath parking lots, local roadways and interchanges near Embarcadero Road, to connect directly to the mainline of U.S. 101 south of the Oregon Expressway (southbound on/northbound off only).

Ramp metering could be included at the Route 84 and U.S. 101 connections to provide a bypass for buses and carpools. The project would include sound mitigation adjacent to residential neighborhoods and also would incorporate appropriate baylands mitigation at a high replacement ratio to be determined by detailed environmental studies.

Figure 21:
Alternative 6 — Dumbarton Approach Roadway



Transportation Effects

The most significant transportation impact of Alternative 6 would be a shifting of congestion away from local arterial roadways in Palo Alto and East Palo Alto to regional facilities. (See Figure 22.) Alternative 6 would result in a reduction of 17 miles of congested arterials in 2025 and an increase in nine miles of congested freeway facilities in the a.m. peak hour, with similar effects in the p.m. Peak-period delays on University Avenue, Willow Road and the Bayfront Expressway would be reduced by more than 50 percent.

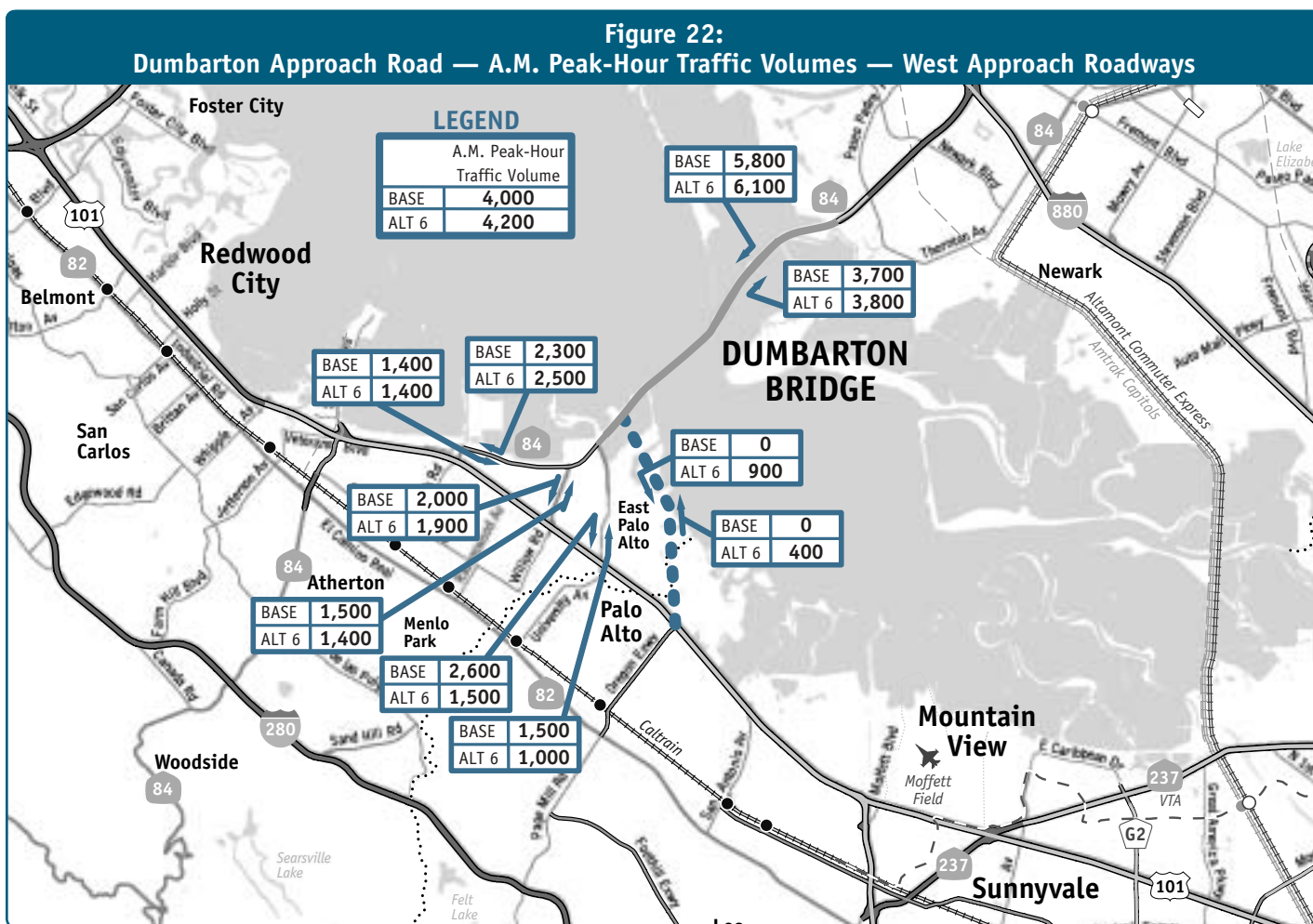
Alternative 6 would result in more efficient utilization of the existing capacity of the Dumbarton Bridge; the daily traffic level would rise from 100,000 vehicle-trips in the baseline to 124,000 vehicle-trips. Two-way peak-period traffic would increase by about 400 vehicles per hour, potentially bringing the bridge to capacity, depending on network constraints such as the toll plaza and regional access routes.

There would be limited regional impacts with

Alternative 6; the greatest effect identified in the traffic impact analysis on regional facilities would be a 1 percent increase in the volume-to-capacity (V/C) ratio of U.S. 101 south of San Antonio Road and a 2 percent increase in the V/C ratio on I-880 north of Route 84. Regional transit utilization would remain unchanged; however, express bus ridership across the Dumbarton Bridge would increase slightly from 1,300 patrons in the baseline to 1,400 patrons with Alternative 6.

Cost

The capital cost of this project is high in relation to its length, due to design considerations included to avoid or mitigate environmental impacts. Depending on the amount or type of tunneling involved, the capital cost is estimated to range from \$670 million to as high as \$1.9 billion. However, the yearly operations and maintenance cost would be the lowest of any alternative considered, at \$3 million over 20 years.



Cost-Effectiveness

The evaluation showed this alternative to be moderately cost-effective, with travel-time savings of 28,600 to 80,600 hours annually per million dollars in annualized cost, depending on the amount of tunneling and associated cost.

Environmental and Socioeconomic Impact

Alternative 6 has the following potential impacts:

- Land-Use and Right-of-Way Impacts — Industrial, school, homes, Palo Alto athletic field
- Potential Fill Within Jurisdictional Wetlands — Salt marsh
- Impacts to Salt Pond, Wetlands, Upland from Causeway (piers)
- Baylands and Special Status Species (Clapper Rail)
- Special-Status Species — In diked wetlands/Ravenswood district
- Localized Air Emissions During Construction
- Visual
- Noise and Visual Impacts to Nearest Homes in East Palo Alto
- Traffic and Local Air Quality Benefits — Selected East Palo Alto, Palo Alto, Menlo Park locations

Public Opinion

This improvement was viewed as a significant, but localized, improvement. It was understood that local communities are severely impacted by the current traffic bottlenecks and that fixing the problem would be of great benefit locally. As in the case of the Dumbarton rail bridge alternative, it does not address the Bay Bridge corridor problem, and for Alternative 6, the capital cost (though not operating cost) is considerably higher than for Dumbarton rail. Impacts on Bay wetlands and neighborhoods are potential environmental problems and received much attention from participants in the Palo Alto public meeting.

Synopsis of Findings

This alternative would improve the utilization of the Dumbarton highway bridge and would result in substantial relief for existing Peninsula access roadways impacted by regional bridge access traffic. The analysis did not identify significant negative regional impacts, but more analysis would be needed to identify localized negative impacts.

The alignments studied would require costly measures to avoid or mitigate environmental impacts. Additional study is warranted to determine whether alternative alignments or solutions could obtain similar benefits with lower impacts.

A follow-on study is being pursued by the San Mateo City/County Association of Governments in cooperation with affected communities.

Comparison of Alternatives

The table below summarizes a comparison of the six alternatives, based on the evaluation results described in the preceding pages. For a detailed

comparative analysis of specific evaluation criteria, see Section 7, Technical Appendix, or the Travel Evaluation Report (June 2002).

San Francisco Bay Crossings Study
EVALUATION SUMMARY TABLE

	Alt 1 Bus/HOV Operational	Alt 2 San Francisco- Oakland Rail/BART	Alt 3* San Mateo- Hayward Bridge/ I-880 Widening	Alt 4 Mid-Bay New Bridge	Alt 5 Dumbarton Rail Bridge	Alt 6 Dumbarton Approach
MOBILITY						
Reduced Transbay Traffic Congestion	□	□	▲	■	□	□
Reduced Regional Traffic Congestion	□	□	□	■	□	□
Regional Travel-Time Savings	▲	▲	▲	■	□	□
Transbay Travel-Time Savings	▲	□	□	■	▲	□
Increased Transbay Travel-Time Reliability	▲	■	□	■	▲	▲
Increased Transbay Mobility Options	▲	■	□	■	▲	□
Increased Transbay Transit Utilization	■	■	□	□	▲	□
Provides Additional Transbay Capacity	▲	■	□	▲	▲	□
COST						
Capital Cost	■	□	▲	□	■	▲
Net Annual O&M Cost	□	□	■	□	▲	■
Cost-Effectiveness	■	□	▲	▲	■	▲
Financial Feasibility	■	□	▲	□	■	■
IMPACT						
Environmental Impacts	■	▲	■	□	▲	□
Community Impacts	■	■	□	□	▲	▲
Air Quality Impacts	■	■	■	■	■	■
IMPLEMENTATION						
Ease of Implementation	■	□	▲	□	■	▲
Public Support	▲	■	▲	□	▲	▲

*Alternative 3 includes the widening of I-880 from I-238 to Route 92.

LEGEND

- High Relative Benefit/Low Relative Impact or Cost
- ▲ Moderate Relative Benefit/Moderate Relative Impact or Cost
- Low Relative Benefit/High Relative Impact or Cost

Sensitivity Analysis

A number of “sensitivity analyses” were conducted as part of the Bay Crossings Study evaluation, to explore policy questions such as the impact of congestion pricing, smart growth land use, and sensitivity of travel demand to higher bridge tolls. This section describes the most significant findings. Selected tables comparing the scenarios are included in Section 7, Technical Appendix.

Congestion Pricing

This test involved applying a \$4 peak-period toll and retaining the existing \$2 off-peak toll. In addition, some of the new revenue generated by the higher peak-period toll was applied to reducing bus/BART transfer costs. Because of the projected growth in real income for Bay Area residents between now and 2025, the \$4 peak-period toll becomes less significant in relation to income over this extended planning horizon. The impact on auto trips is therefore marginal (1,000 daily auto trips combined with 4,000 additional transit riders). Such a toll differential would likely have a greater effect if implemented today, and public support for the concept of higher peak-period tolls seems to be increasing, as evidenced in the telephone poll of voters conducted as part of public outreach.

Increased HOV-Lane Occupancy Requirements

This test assumed that occupancy requirements for HOV-lane users on U.S. 101 and I-880 would be raised from the present 2+ persons to 3 or more people in a vehicle and that the HOV lanes on the bridge approaches would continue across the bridges themselves by taking a lane. The analysis further assumed the additional carpool-lane improvements associated with Alternative 1, such as the expanded regional express bus system and strategic HOV-lane improvements leading to the bridge approaches. Three-person carpools increased as expected, and daily vehicle trips decreased by 33,300 (4.9 percent). With the robust express bus system operating on HOV lanes, transit ridership also increased by 28,000 daily riders (9.9 percent), the highest of any of the sensitivity analysis.

However, with respect to 3+ HOV lanes on the bridges themselves, neither the San Mateo-Hayward nor the Dumbarton Bridge HOV lanes exhibit sufficient 3+ carpool volumes to make them an exclusive 3+ lane. Operational problems could exist on the Bay Bridge, even with the higher projected 3+ utilization (around

70 percent). This is because any unused capacity in the lanes would normally be filled by vehicles using the bridge after they had passed the westbound metering lights. Even the loss of a small amount of peak-period lane capacity during the most congested hours would have adverse impacts on bridge operations.

Smart Growth Land Use

This test performed very well overall. One of the three alternative smart growth scenarios being studied by the regional agencies — the Central Cities scenario, which focuses development in the urban core and around transit — was used for the travel forecasts. The demographic assumptions in this alternative represent a dramatic departure from current trends by shifting population to better match job growth in Alameda, Santa Clara, San Mateo and San Francisco counties. Because the analysis was conducted for a 2020 planning horizon and not 2025 (as was the case with the other sensitivity tests), the results are not directly comparable, but they still are significant — 50,000 fewer daily transbay vehicle-trips and 17,000 more daily transit riders. Also, the smart growth project is finding more consensus around one of the other two land-use scenarios, which would have different, perhaps less robust, results.

Blueprint Projects

This test evaluated the impact of various transportation projects not currently in the RTP (due to funding shortages or other factors) but which could conceivably have some indirect impacts on transbay travel behavior if implemented. The effects were, however, found to be minimal.

Accessibility Impacts of a New Mid-Bay Bridge (Alternative 4)

For ease of comparison, all of the six crossing alternatives have been evaluated using the same 2025 travel patterns, that is, the same number of trips between various East Bay and West Bay origin and destination zones. While this is a good first-cut approximation of future travel (and consistent with the approach used in most corridor studies), a new bridge could increase the number of trips between these same origins and destinations by virtue of changing the accessibility or travel time it takes to get from one location to another. To gauge this potential effect, MTC

recalculated the number of trips that would potentially occur between zones by factoring in the increased accessibility.

Compared to the original Alternative 4 analysis, transbay vehicle volumes go up 14,000 daily (2 percent), and transbay transit use declines 1.5 percent. Even with these increased vehicle-trips crossing the Bay, peak-period delay is still reduced 19 percent compared to the baseline.

Sensitivity Test to Higher Tolls

Since any of the major transbay improvements would likely rely on significant toll increases as part of their financial package, a sensitivity test was performed on traffic volumes assuming a toll of \$9 (existing \$2 plus \$7 increase) on the three study area bridges. This test also included the new mid-Bay bridge, which would be one of the most expensive projects that could create the need for such a large toll increase. Compared to the alternative studied with a new mid-Bay bridge, but without a higher toll, transbay vehicle volumes drop some 13,400 (1.9 percent) with a \$9 toll. Even with the much higher tolls, transbay vehicle volumes would still be about 2 percent higher than the 2025 baseline due to the additional vehicles that would be accommodated by the new six-lane mid-Bay bridge. Transbay transit use would remain slightly lower than the baseline (1 percent) with a new bridge and higher toll.

SECTION

5 Funding Transbay Improvements

Many of the ambitious improvements examined in the Bay Crossings Study would require additional funds. Mindful that legislation to authorize a vote on raising bridge tolls is likely to be introduced in 2003, the primary funding mechanism examined in the Bay Crossings Study was an increase in tolls on state-owned bridges.

There is precedent for increasing tolls on Bay Area state-owned bridges to fund major transportation improvements in bridge corridors. Indeed, a number of recently completed or ongoing bridge improvements are funded by Regional Measure 1, which was passed by Bay Area voters in 1988 and which increased the toll on all state-owned bridges in the region to \$1. Improvements funded under Regional Measure 1 include the widening of the San Mateo-Hayward Bridge to six lanes, ongoing construction of a new Benicia-Martinez Bridge, and ongoing replacement of the western span of the Carquinez Bridge. Funds from Regional Measure 1 also have been used for transit capital improvements designed to remove traffic from the bridges.

The Bay Crossings Study examined increased bridge tolls as a potential new funding source from two perspectives. First, a toll revenue analysis was conducted to determine the magnitude of toll increase required to fund each improvement. Second, focus group participants, stakeholders and the public were polled to assess the level of public support for toll increases of varying magnitudes.

Funding Specific Improvements

For the toll revenue analysis, the six study alternatives were divided into discrete improvements. The analysis looked at the additional toll that would be required on all state-owned bridges and the additional toll that would be required on just the Southern Bridge Group (San Francisco-Oakland Bay, San Mateo-Hayward and Dumbarton bridges, and for Alternative 4 only — the new mid-Bay bridge). The results of this analysis for the improvements in each alternative are summarized in Tables 8 and 9 below.

Table 8: Improvements Requiring Less Than One-Dollar Toll Increase on Southern Bridge Group

	Additional Toll	
	<u>All Bridges</u>	<u>Southern Bridges</u>
Alternative 1 Low-Cost HOV-Lane Improvements	\$0.04	\$0.07
Alternative 1 Low- and High-Cost HOV-Lane Improvements	0.15	0.26
Alternative 1 Express Bus Expansion (all corridors)	0.27	0.48
Alternative 1 Three-Door BART Cars	0.15	0.27
Alternative 3 San Mateo-Hayward Bridge Reversible Lanes	0.03	0.05
Alternative 5 Dumbarton Rail Basic Service	0.06	0.10
Alternative 5 Dumbarton Rail Expanded Service	0.21	0.38

Table 9: Improvements Requiring More Than One-Dollar Toll Increase on Southern Bridge Group

	Additional Toll	
	<u>All Bridges</u>	<u>Southern Bridges</u>
Alternative 2 New BART Tunnel and Stations	\$8.39 - \$11.80	\$4.71 - \$6.62
Alternative 2 New Rail Tunnel (two legs)	8.22 - 12.84	4.61 - 7.21
Alternative 2 New Rail Tunnel (northern leg only)	4.90 - 8.65	2.75 - 4.85
Alternative 3 San Mateo-Hayward Bridge Widening	2.35 - 2.68	1.32 - 1.50
Alternative 4 New Mid-Bay Bridge	6.44 - 8.14	3.82 - 4.82
Alternative 6 Route 84/U.S. 101 Connector	0.73 - 2.04	0.41 - 1.14

Public Opinion

Survey respondents in the second telephone poll were asked about their support for higher tolls at various levels. First, they were asked whether any new bridge crossing should be paid for by a toll increase on only the new crossing or spread evenly over all three existing bridges and a new bridge. Of those polled, 67 percent support spreading the higher toll evenly over all bridges, compared to 25 percent who support a toll on the new bridge only.

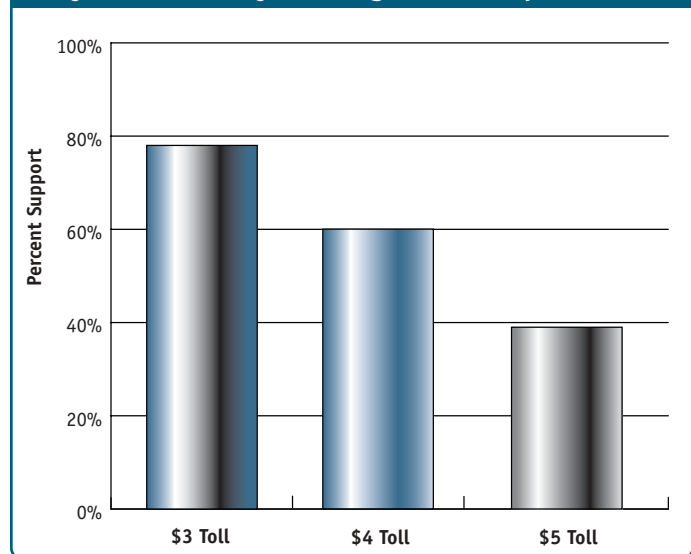
They were then asked how high a toll they would favor to pay for a new facility, given ranges from three dollars up to six dollars. Following are the results showing each toll level and the degree of support (see Figure 23):

- 3 dollars: 77 percent
- 4 dollars: 61 percent
- 5 dollars: 39 percent
- 6 dollars: 30 percent

This result is comparable to the response from the participants in the focus groups, stakeholder interviews and public meetings. Most supported at least a three-dollar toll, a majority supported a four-dollar toll, and a significant minority supported a five-dollar toll. The conclusion is that there is a substantial degree of acceptability for some bridge toll increase.

It is notable that this is the one survey question on which a striking contrast emerged between the 2002

Figure 23: Support for Increased Tolls to Pay for a New Bay Crossing – Public Opinion Poll



survey and the telephone poll conducted a year earlier. In 2001, the support for a three-dollar toll was 57 percent (compared to 77 percent in 2002), and only 26 percent for a four-dollar toll (compared to 61 percent in 2002).

The idea of variable bridge tolls also was tested in the telephone survey. A scenario was presented in which four dollars would be charged during peak periods and two dollars during non-peak. The public supports this concept by a margin of 62 percent in favor and 34 percent against; this was less than the 80 percent margin among focus group/stakeholder participants, but still substantially favorable.

SECTION

6 Conclusions and Recommendations

General Context for Recommendations

- A major new Bay crossing has intrigued the public for a long time, but has not yet received a critical mass of support.
- The most recent interest in new crossing options reflects the dramatic rise in traffic and congestion resulting from the latest economic expansion in the Bay Area and the continuing separation of jobs and housing.
- Transbay travel over the next 25 years is expected to outpace the average regional rate of growth in travel.
- A large set of potential solutions was proposed in the scoping stage of the Bay Crossings Study. The study focused on the major themes and strategies that arose out of this public process.
- A parallel effort by the new Bay Area Water Transit Authority is formulating a proposal to augment and expand ferry service on the Bay; its plan is to be submitted to the state Legislature in December 2002.
- A regional Smart Growth Planning Initiative is under way and will define an alternative land-use development pattern that, if implemented, could result in lower levels of transbay travel than currently projected in this study.
- The Policy Committee expressed a strong interest in exploring lower-cost operational improvements that could be implemented as a near-term response to traffic congestion in the bridge corridors.
- Major new crossing improvements will be extremely costly, in some cases requiring funding equal to or exceeding the entire amount of new regional funds estimated to be available over the next 25 years in MTC's latest *Regional Transportation Plan*.
- There is an opportunity to seek new regional funding from a possible increase in Bay Area bridge tolls (state Sen. Don Perata's initiative) to improve transbay travel options by all modes.

Conclusions by Alternative

ALTERNATIVE

1 *Express Bus, Carpool and Operational Improvements*

- One of the most cost-effective alternatives studied.
- This package of carpool, express bus and operational improvements can be tailored to meet evolving needs and fit within funding constraints. Individual high-occupancy-vehicle (HOV) lanes, traffic operational improvements and park-and-ride facilities can be developed as separate projects and express buses can be added as transit demand increases.
- In addition to showing the promise of a regional express bus system to serve future transit demand (upwards of 36,000 daily riders in 2025), this alternative also provides significant travel-time savings for carpoolers.
- Assuming that near- and longer-term plans presently under development by BART to address systemwide and transbay capacity are successfully implemented, projected demand for transbay BART service can be handled primarily by adding additional trains and pursuing strategies for faster loading/unloading of trains in San Francisco. Adequate platform space in downtown San Francisco stations may become a capacity constraint by or before 2025.

ALTERNATIVE

2 *New BART and/or Conventional Rail Tunnel in Bay Bridge Corridor*

- The public expressed keen interest in crossings that involve alternatives in the form of BART, conventional and high-speed rail (HSR).
- A new rail crossing should be viewed as a very long-term investment that could provide for growth in transit demand beyond 2025. A new rail tunnel would improve transit reliability and redundancy, reduce crowding on BART trains, and provide more conven-

ient access to additional destinations in San Francisco and Oakland.

- A BART or rail tunnel under the Bay would be the most costly of the six alternatives studied — capital costs range from \$7 billion to more than \$11 billion for tunnels with maximum operational flexibility. A conventional rail tunnel with more limited service to Emeryville and points north could be constructed for \$4.5 billion to \$8 billion.
- Overall, this alternative produces the highest level of transit use, but the high cost and modest travel-time savings contribute to a low cost-effectiveness rating.
- A conventional rail tunnel also could be used by high-speed rail, but there are no current plans for HSR service in this corridor.
- Significant environmental impacts include disposal of excavated soils as well as land-use and construction impacts at new stations in San Francisco and Oakland.

ALTERNATIVE

3

Reversible Lane and Widening of San Mateo-Hayward Bridge to Eight Lanes

- Near-term travel improvements will occur in this corridor with the opening of the new six-lane causeway (late 2002) and the easterly extension of the HOV lane approaching the toll plaza to Hesperian Boulevard.
- As traffic grows and demand approaches the capacity of the widened bridge, a reversible lane would be an inexpensive (\$40 million capital) and cost-effective way to address peak-direction demand in the near term. However, travel in the reverse-peak travel lanes would likely exceed capacity by 2010–15.
- Beyond the reversible lane, the bridge could be further widened to eight lanes for a cost of around \$1.8 billion to \$2.4 billion, depending on the need for related Interstate 880 improvements. The public generally favors widening an existing bridge over constructing a new bridge. A widened bridge could serve projected San Mateo-Hayward Bridge corridor traffic through at least 2025.
- The San Mateo-Hayward Bridge corridor does not exhibit a strong transit market due to the many-origins-to-many-destinations characteristics of trips across the bridge, limiting feasibility of rail or other major transit investment.

- Community concerns focused largely on the potential need for widening I-880, which would impact 350–400 lots if this improvement is required as part of an ultimate widening of the bridge to eight lanes. This issue would need further study.

ALTERNATIVE

4

New Bridge Between Interstates 238 and 380

- A new mid-Bay bridge would have the greatest impact on reducing vehicle hours of delay, even with the additional vehicle-trips that would result with the new bridge.
- Corollary effects include significant reductions of traffic on the San Mateo-Hayward Bridge, and a reduction in the duration of the peak period as well as a marginal decrease in peak-period traffic on the San Francisco-Oakland Bay Bridge. Impacts to Bay Area freeways would be generally positive due to a reduction in circuitous travel over existing bridges. As would be expected, certain sections of Peninsula and East Bay freeways would receive more traffic, while others would receive less as travelers shift their bridge routes.
- Improved auto travel times would lower transbay transit use by about 20,000 daily riders in 2025, from 280,000 daily transit trips in the baseline to 260,000 with the new bridge.
- A new six-lane mid-Bay bridge would come at a high cost (\$6.6 billion to \$8.2 billion). Adding a rail crossing would increase costs another \$5 billion to \$6.5 billion, not including stations and rolling stock.
- A significant proportion of the construction cost would be incurred in the approach roadways, especially in the East Bay where aerial sections and tunneling would be necessary to minimize impacts to existing communities and structures.
- Environmental impacts include displacement of residences (over 100 units) and businesses near the expanded I-880/I-238 interchange, Bay fill for toll plaza construction and potentially significant impacts to wetlands and special status species.
- A new bridge engendered the strongest public reaction, both pro and con. Public concerns focus on environmental, traffic and local land-use impacts. Bridge supporters expressed a belief that this is the only option that could significantly relieve existing and future traffic congestion.

ALTERNATIVE

5 *Dumbarton Rail Service*

- Initiating rail service using the existing Dumbarton rail bridge is popular with the public, even though the public understands that it likely will have limited impact on traffic in the corridor.
- This is one of the least expensive and more cost-effective of the transbay improvements studied.
- Funding for the basic reconstruction of the rail bridge is included in the current *Regional Transportation Plan* (RTP), although the cost of rehabilitating or replacing the rail bridge likely will exceed the current funding, due to the need for greater seismic protection. Operations and maintenance funds have yet to be identified.
- The basic start-up service would connect the Union City BART station with Caltrain tracks on the Peninsula, serving some 3,000 to 4,000 daily riders in 2025. Expansion of service to other East Bay points could nearly double this ridership level.
- Potential environmental issues include train noise and vibration in nearby communities as well as traffic impacts at five existing grade crossings on the Peninsula.
- Potential environmental issues associated with a new road along the Bay shoreline include its effect on wetlands and marshes (both direct and indirect), salt ponds, special status species (Clapper Rail), and residential, school and industrial land uses.
- Not unexpectedly, residents in the area have strong feelings about the alignment, both pro and con.

ALTERNATIVE

6 *New Dumbarton Approach Road to the South*

- A new southerly connection to the Dumbarton Bridge could provide more direct access to travelers heading to jobs in Silicon Valley and communities south of the bridge.
- An expanded approach-road system would balance regional through-traffic impacts on local communities (reducing peak-period delays more than 50 percent on University Avenue, Willow Road and the Bayfront Expressway), while improving the utilization of the Dumbarton Bridge's existing capacity.
- In order to minimize community and environmental impacts, much of a new two- to four-lane road between the Dumbarton Bridge and U.S. 101 would be below grade or in a tunnel, and would have a high construction cost (\$670 million to \$1.9 billion) in relation to the projected use (25,000 daily vehicles in 2025).

Policy Issues

In addition to the six final alternatives, a number of policy considerations were analyzed as “sensitivity tests.” The most significant results are summarized below.

- **Peak-Period Congestion Pricing:** In 2025, a low-level congestion pricing strategy (\$4 in the peak and the current \$2 in the off-peak) would have minimal effects on bridge congestion, because of the lengthening of the peak traffic period and the relatively low toll level compared to household income in 2025. In the near term, such a strategy would have a more demonstrable impact and appears to resonate with the public.
- **Smart Growth Land Use:** To test land-use impacts on transbay travel, one of the three alternative land-use scenarios proposed as part of the Regional Agencies Smart Growth Initiative was evaluated — the 2020 “Central Cities” scenario, which focuses development in the urban core and around transit. These large-scale land-use changes, compared to currently assumed development trends, reduced transbay travel

more than any of the transportation alternatives studied — 50,000 fewer daily transbay vehicle-trips and 17,000 more daily transit riders than the 2025 baseline. While the Smart Growth work is now focusing on a different scenario, it can be assumed that significant changes also would occur in projected transbay travel with this scenario as well.

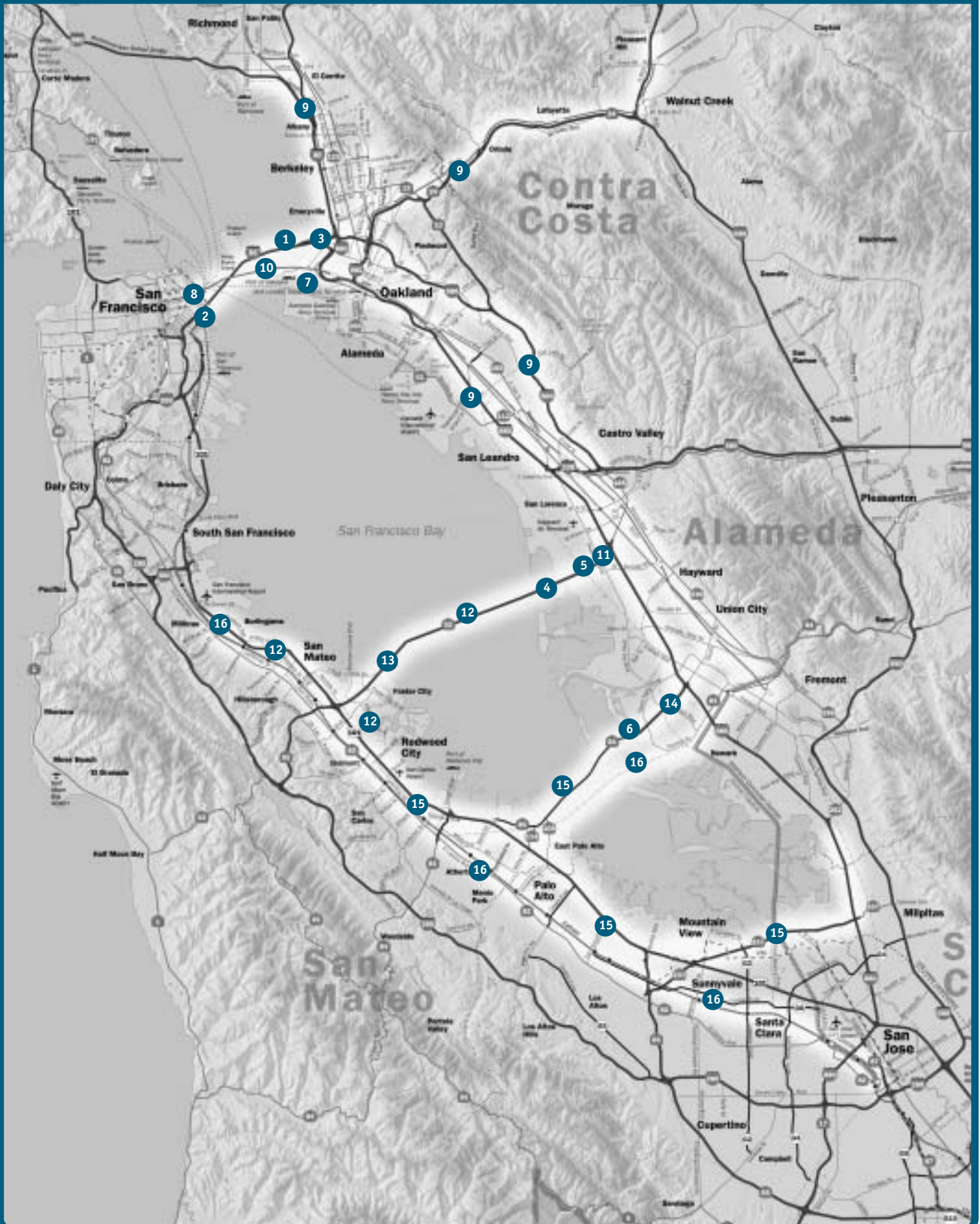
- **Increasing HOV-Lane Occupancy Requirements to 3+** on the San Mateo-Hayward and Dumbarton bridges and taking a lane on all three Bay bridges for carpools and buses: While this alternative performed well in the analysis, shifting persons to 3+ carpools and increasing transit ridership on buses using carpool lanes would result in the 3+ HOV lanes across the San Mateo-Hayward and Dumbarton bridges being significantly underutilized. This condition also would produce overcrowding in the adjacent mixed-flow lanes. A similar situation would arise on the Bay Bridge due to normal fluctuations in HOV-lane demand during the peak period.

Bay Crossings Study Recommendations by Corridor

	With Existing Funds	With Potential \$1 Toll Increase	Related Follow-up and Further Study
San Francisco-Oakland	<ol style="list-style-type: none"> 1 Carpool lane extensions/improvements on Bay Bridge approaches in Oakland (I-880 northbound, isolate left-side and right-side carpool lanes at toll plaza) 2 Carpool improvements/signage on San Francisco city streets (2nd Street, Fremont/Howard streets, Sterling on-ramp) 3 I-80 westbound approach to Maritime off-ramp — truck deceleration lane <p>Capital Cost: \$4.2 million Operating Cost: \$4.5 million (20-Year Net)</p>	<ol style="list-style-type: none"> 7 Additional carpool-lane extensions/improvements on Bay Bridge approaches in Oakland (Grand Avenue on-ramp; westbound I-580 left and right sides; I-880 northbound to Market/Adeline) 8 Additional carpool improvements on San Francisco city streets (Bryant and Beale streets, Essex Street on-ramp, Sterling on-ramp) 9 Expanded express bus service (increase to 158 peak-hour trips) 10 BART core capacity enhancements (purchase and operation of 47 new cars) <p>Capital Cost: \$416.4 million Operating Cost: \$357.4 million (20-Year Net)</p>	<p>Not mapped:</p> <ul style="list-style-type: none"> • Coordinate with High-Speed Rail Authority to serve Bay Area-Sacramento market • Additional analysis of BART core-capacity improvements • Coordinate with Water Transit Authority on possible new ferry service
San Mateo-Hayward	<ol style="list-style-type: none"> 4 Re-establish express bus service (two peak-hour trips in each direction) 5 Extend FasTrak™ approach lane at toll plaza <p>Capital Cost: \$4.3 million Operating Cost: \$2.0 million* (20-Year Net)</p>	<ol style="list-style-type: none"> 11 Carpool-lane improvements (Route 92 gap closure between Hesperian and I-880 in Hayward) 12 Expanded express bus service (increase to 10 peak-hour trips, new park-and-ride lot and Route 92 carpool on-ramp at Hesperian) 13 Reversible lanes on high-rise portion of San Mateo-Hayward Bridge (potentially designate reversible lane for carpools and buses) <p>Capital Cost: \$134.5 million Operating Cost: \$97.6 million (20-Year Net)</p>	<p>Not mapped:</p> <ul style="list-style-type: none"> • Add San Mateo-Hayward Bridge widening (to eight lanes) to the Blueprint portion of the next <i>Regional Transportation Plan</i> update. <ul style="list-style-type: none"> — Potential capital cost: \$2.1 billion to \$2.4 billion — Potential 20-year operating cost: \$38.5 million • Coordinate with Water Transit Authority on possible new ferry service
Dumbarton	<ol style="list-style-type: none"> 6 Extend FasTrak™ approach lane at toll plaza <p>Capital Cost: \$37,000 Operating Cost: \$0 (20-Year Net)</p>	<ol style="list-style-type: none"> 14 Carpool-lane improvements (Route 84/I-880 direct carpool flyover ramps in Fremont) 15 Expanded express bus service (increase to 10 peak-hour trips, new park-and-ride lot, and Route 84 carpool on-ramp) 16 Rail service on the Dumbarton rail bridge (seismic upgrade of existing rail bridge and operation of six peak-period trains between Union City and the Peninsula) <p>Capital Cost: \$186.6 million Operating Cost: \$151.9 million (20-Year Net)</p>	<p>Not mapped:</p> <ul style="list-style-type: none"> • Cooperative study of western approach and U.S. 101 corridor by Santa Clara Valley Transportation Authority, San Mateo City/County Association of Governments, and San Mateo County Transportation Authority (under way)

* Includes three years of express bus; remainder to be funded with potential toll increase.

Map of Study Recommendations



Recommendations for Near-Term Implementation

A. Pursue With Existing Funds:

1. Re-establish express bus service on the San Mateo-Hayward Bridge to test the transit market under current conditions.
2. Proceed with very low-cost projects identified in Alternative 1 that have been determined to provide significant near-term operational benefits:
 - Bay Bridge: I-80 westbound approach to Maritime off-ramp — truck deceleration lane
 - Bay Bridge: I-880 northbound HOV-lane approach extension — pave and restripe
 - Bay Bridge Toll Plaza — Isolate left- and right-side HOV lanes
 - Bay Bridge: downtown San Francisco casual carpool unloading zone (near Fremont/Howard) and additional South of Market carpool formation zone (near Second Street) — provide signage and curb restriping
 - Bay Bridge: Restripe and extend 2nd Street HOV lane eastward towards King Street in San Francisco (phased expansion)
 - Bay Bridge: Improve signage and striping at Sterling Street on-ramp in San Francisco
 - San Mateo-Hayward Bridge: Extend FasTrak™ approach lane — restripe existing right lane
 - Dumbarton Bridge: FasTrak™ improvements — restripe existing right lane

B. Pursue Bridge Toll Funding for the Following Transbay Improvements

State Sen. Don Perata has signaled his intention to introduce legislation next year to authorize a regional vote on raising tolls to \$3 on all seven state-owned bridges. This legislation would provide an opportunity to fund a number of improvements identified in this study. The required toll increase increment for each project is shown in parentheses, assuming the toll is applied to all seven state-owned toll bridges.

1. Reversible lanes on San Mateo-Hayward Bridge (\$.03)

2. Dumbarton Rail Basic Service (\$.06)

- Additional costs for seismic upgrade (\$.03)
- Subsidy for operations: Operate six peak-period trains between Union City and Peninsula (\$.03)

3. Carpool-Lane Improvements (\$.15):

Lower-Cost Bridge Carpool Improvements: (\$.04)

- Bay Bridge: I-880 northbound HOV-lane approach extension to Market/Adeline streets — pave and restripe
- Bay Bridge HOV improvements to Essex Street ramp (San Francisco)
- Bay Bridge extension of HOV lane on Bryant and Beale streets (San Francisco)
- Bay Bridge westbound Grand Avenue on-ramp HOV-lane extension (Oakland)
- Bay Bridge westbound I-580 left-side HOV-lane extension (Oakland)
- Improved geometrics at Sterling Street on-ramp (San Francisco)

Higher-Cost Bridge Carpool Improvements: (\$.11)

- Westbound I-580 right-side HOV lane (Oakland)
- Close Route 92 HOV-lane gap between Hesperian and I-880 (Hayward)
- Route 84/I-880 HOV-lane direct flyover connection (Fremont)

4. BART Core-Capacity Improvements (\$.15)

- Purchase and operation of 47 additional three-door BART cars

5. Express Bus Expansion in All Three Bridge Corridors (\$.27)

- Increase Bay Bridge peak-hour trips from 96 to 158
- Increase San Mateo-Hayward Bridge peak-hour trips from zero to 10
- Increase Dumbarton Bridge peak-hour trips from four to 10

6. Transbay Terminal

- While not considered explicitly in this study, the Transbay Terminal is recommended in conjunction with the expanded express bus service.

Recommendations for Further Study

1. Higher-Cost Bridge HOV-lane Improvements Identified Above (Caltrans lead): Prepare project study reports (PSRs) for westbound I-580 right-side HOV lane, closure of Route 92 HOV-lane gap between Hesperian and I-880, and the Route 84/I-880 HOV-lane direct flyover connection.
2. Dumbarton Approach Improvements (San Mateo/Santa Clara county lead): Given the difficult technical and environmental issues, further study of this corridor is recommended. The study area should be expanded to include the U.S. 101 corridor from Woodside Road to Route 85 in Mountain View and should involve all local affected parties. This study should address a range of issues, including different approach-road connections to U.S. 101, the extension of the Bayfront Expressway to Woodside Road, localized issues with U.S. 101 interchanges, land development issues in the corridor, and developing public consensus.
3. BART Core-Capacity Enhancements (BART lead): Further analysis is required to determine the appropriate capital improvements to expand BART transbay capacity beyond the purchase of three-door cars recommended above. Options to be examined would include station-capacity improvements (improved stair/escalator access/egress).
4. As part of MTC's ongoing *HOV-Lane Master Plan Study*, further develop specific transbay express bus proposals, assess the potential for designating a reversible lane on the San Mateo-Hayward Bridge for 2+ HOV use, and examine taking an existing lane for a dedicated HOV/express bus lane on the Bay Bridge. For preferential HOV/express bus treatment over the bridges, focus on toll plaza operational strategies, including metering rates.
5. San Mateo-Hayward Bridge Reversible-Lane Operation (MTC lead): Conduct an operational study of the feasibility of a reversible lane on the San Mateo-Hayward Bridge. This study should immediately follow the completion of the Bay Crossings Study, using remaining funds allocated by the California Transportation Commission for the Bay Crossings Study. The operational feasibility of the reversible lane should be determined in time for the project to be considered for funding as part of possible toll increase legislation.

Related Follow-Up Items

1. Continue to coordinate with High-Speed Rail Authority with respect to its plans for serving the San Francisco Bay Area and Sacramento.
2. Continue to coordinate with the San Francisco Bay Area Water Transit Authority with respect to its plans for expanded transbay ferry service.
3. Support continuing work to develop regional consensus on a Smart Growth Land-Use alternative, as alternative land-use assumptions have been shown to have major effects on long-term transbay travel demand.
4. When the RTP is next updated, add the widening of the San Mateo-Hayward Bridge to the list of "Blueprint" projects in the RTP. This project is of continuing interest to the public, but does not yet have consensus and/or identified funding.

SECTION

7

Technical Appendix

Table 10: Daily Person-Trips by Bridge Corridor and Mode in 2025

Bay Bridge Corridor	2025 Baseline		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Persons	Percent	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change
Single-Occupant Vehicle	386,000	50%	384,000	0%	382,000	-1%	386,000	0%	363,000	-6%	386,000	0%	386,000	0%
Carpool	105,000	14%	105,000	0%	102,000	-2%	103,000	-2%	107,000	2%	104,000	-1%	104,000	-1%
BART	254,000	33%	235,000	-7%	269,000	6%	252,000	-1%	235,000	-7%	252,000	-1%	253,000	0%
Commuter Rail	0	0%	0	0%	16,000	0%	0	0%	0	0%	0	0%	0	0%
Express Bus	19,800	3%	43,400	120%	17,000	-14%	20,000	1%	21,400	8%	20,000	1%	19,900	1%
Ferry	7,060	1%	7,090	0%	7,060	0%	7,060	0%	7,060	0%	8,410	19%	7,060	0%
TOTAL	772,000	100%	775,000	0%	793,000	3%	769,000	0%	733,000	-5%	770,000	0%	769,000	0%
San Mateo-Hayward Bridge Corridor	2025 Baseline		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Persons	Percent	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change
Single-Occupant Vehicle	144,000	80%	142,000	-2%	143,000	-1%	146,000	1%	112,000	-22%	143,000	-1%	135,000	-7%
Carpool	35,700	20%	33,000	-8%	34,300	-4%	43,200	22%	22,200	-31%	34,800	-4%	29,500	-18%
Express Bus	0	0%	6,200	0%	0	0%	0	0%	0	0%	0	0%	0	0%
TOTAL	180,000	100%	181,000	0%	177,000	-2%	189,000	5%	134,000	-24%	178,000	-2%	164,000	-9%
Dumbarton Bridge Corridor	2025 Baseline		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Persons	Percent	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change
Single-Occupant Vehicle	92,100	80%	93,500	1%	92,800	1	92,200	0%	92,800	1%	91,700	0%	110,000	19%
Carpool	22,200	19%	19,500	-12%	23,400	6%	19,800	-10%	25,000	14%	22,100	0%	33,800	53%
Commuter Rail	0	0%	0	0%	0	0%	0	0%	0	0%	5,940	0%	0	0%
Express Bus	1,280	1%	2,200	72%	1,320	2%	1,340	5%	1,300	1%	390	-69%	1,400	29%
TOTAL	116,000	100%	115,000	0%	118,000	2%	113,000	-2%	119,000	3%	120,000	4%	145,000	24%
New Mid-Bay Bridge Corridor	2025 Baseline		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Persons	Percent	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change
Single-Occupant Vehicle	-	-	-	-	-	-	-	-	77,000	78%	-	-	-	-
Carpool	-	-	-	-	-	-	-	-	20,400	21%	-	-	-	-
Express Bus	-	-	-	-	-	-	-	-	1,600	2%	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	99,000	100%	-	-	-	-
Total All Corridors	2025 Baseline		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Persons	Percent	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change	Persons	Change
Single-Occupant Vehicle	622,100	58%	619,500	0%	617,800	-1%	624,200	0%	644,800	4%	620,700	0%	631,000	1%
Carpool	162,900	15%	157,500	-3%	159,700	-2%	166,000	2%	174,600	7%	160,900	-1%	167,300	3%
Transit	282,140	26%	293,890	4%	310,380	10%	280,400	-1%	266,360	-6%	280,800	0%	281,360	0%
TOTAL	1,067,140	100%	1,070,890	0%	1,087,880	2%	1,070,600	0%	1,085,760	2%	1,062,400	0%	1,079,660	1%

Table 11: Daily Vehicle Volumes (Two Directions) in 2025

Crossing	2025 Baseline	Alt 1 Exp Bus/ HOV	Alt 2 Bay Bridge Rail	Alt 3 San Mateo- Hayward Bridge Widening	Alt 4 New Mid- Bay Bridge	Alt 5 Dumbarton Rail	Alt 6 Dumbarton Approach
Bay Bridge	425,200	423,600	420,300	424,600	401,900	424,500	424,300
San Mateo-Hayward Bridge	159,500	155,700	157,200	164,500	121,200	157,600	147,400
Dumbarton Bridge	101,400	101,700	102,700	100,500	103,300	101,000	124,000
New Mid-Bay Bridge	0	0	0	0	86,100	0	0
TOTAL	503,400	686,100	680,900	680,300	689,600	712,600	683,100

Table 12: Four-Hour A.M. Peak-Period Vehicle Volumes in 2025

Crossing	Dir	2025 Baseline	Alt 1 Exp Bus/ HOV	Alt 2 Bay Bridge Rail	Alt 3- San Mateo- Hayward Bridge Widening	Alt 4 Mid-Bay Bridge	Alt 5 Dumbarton Rail	Alt 6 Dumbarton Approach
Bay Bridge	EB	38,300	38,100	38,000	38,100	34,200	38,300	38,300
	WB	47,600	47,100	47,200	47,000	41,900	47,500	47,600
San Mateo-Hayward Bridge	EB	18,000	17,700	17,900	18,800	14,300	18,000	17,900
	WB	24,200	24,000	23,900	27,000	20,100	24,000	24,000
Dumbarton Bridge	EB	13,700	13,700	13,600	13,200	12,100	13,700	14,000
	WB	23,200	24,000	23,100	22,400	20,200	22,900	24,700
New Mid-Bay Bridge	EB	0	0	0	0	10,600	0	0
	WB	0	0	0	0	21,300	0	0
TOTAL		117,700	165,000	164,100	163,800	166,400	174,600	164,400

Figure 24: Traffic Analysis
A.M. Peak-Period V/C Ratios

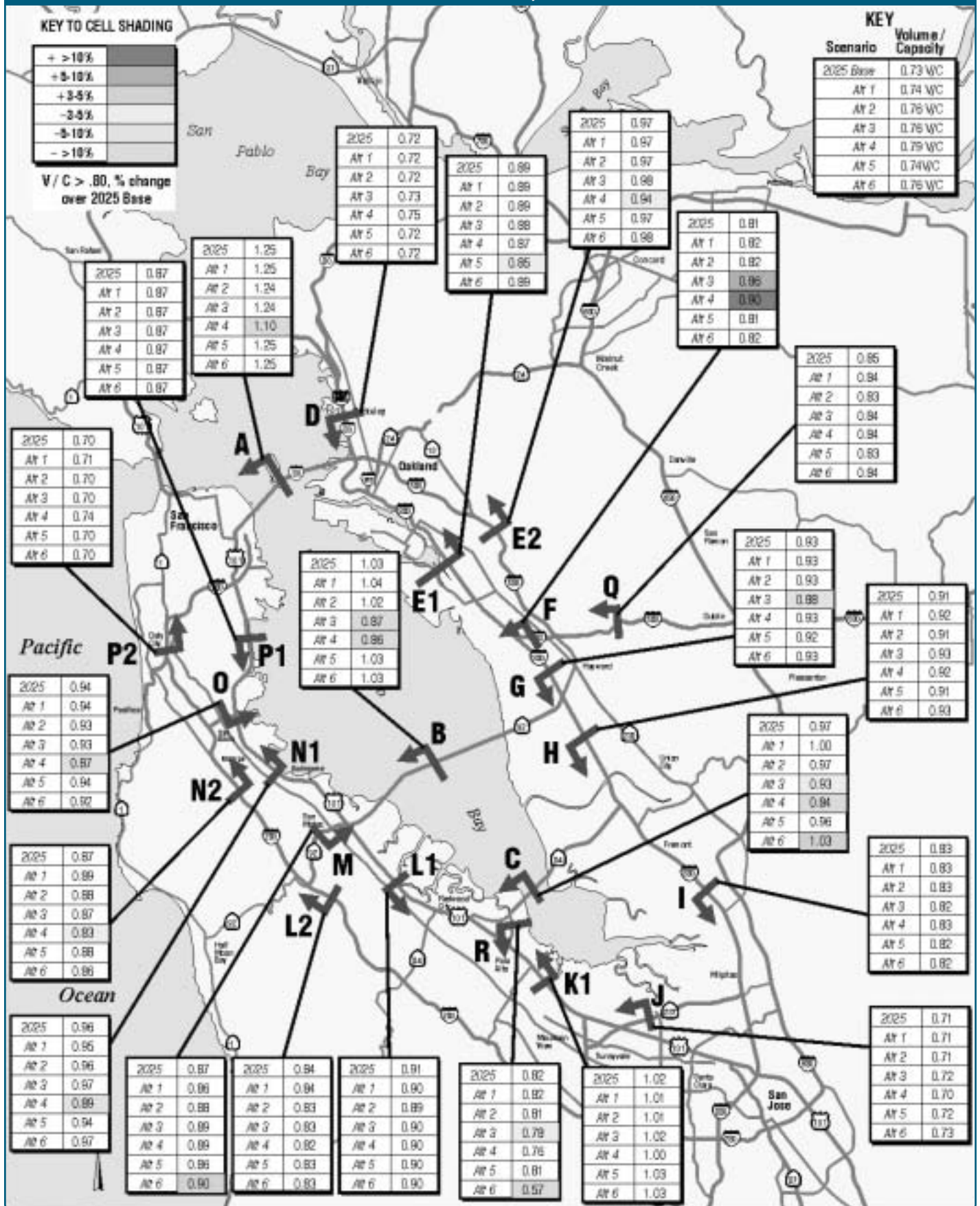


Figure 25: Traffic Analysis
Two-Hour A.M. Peak-Period Hours of Delay

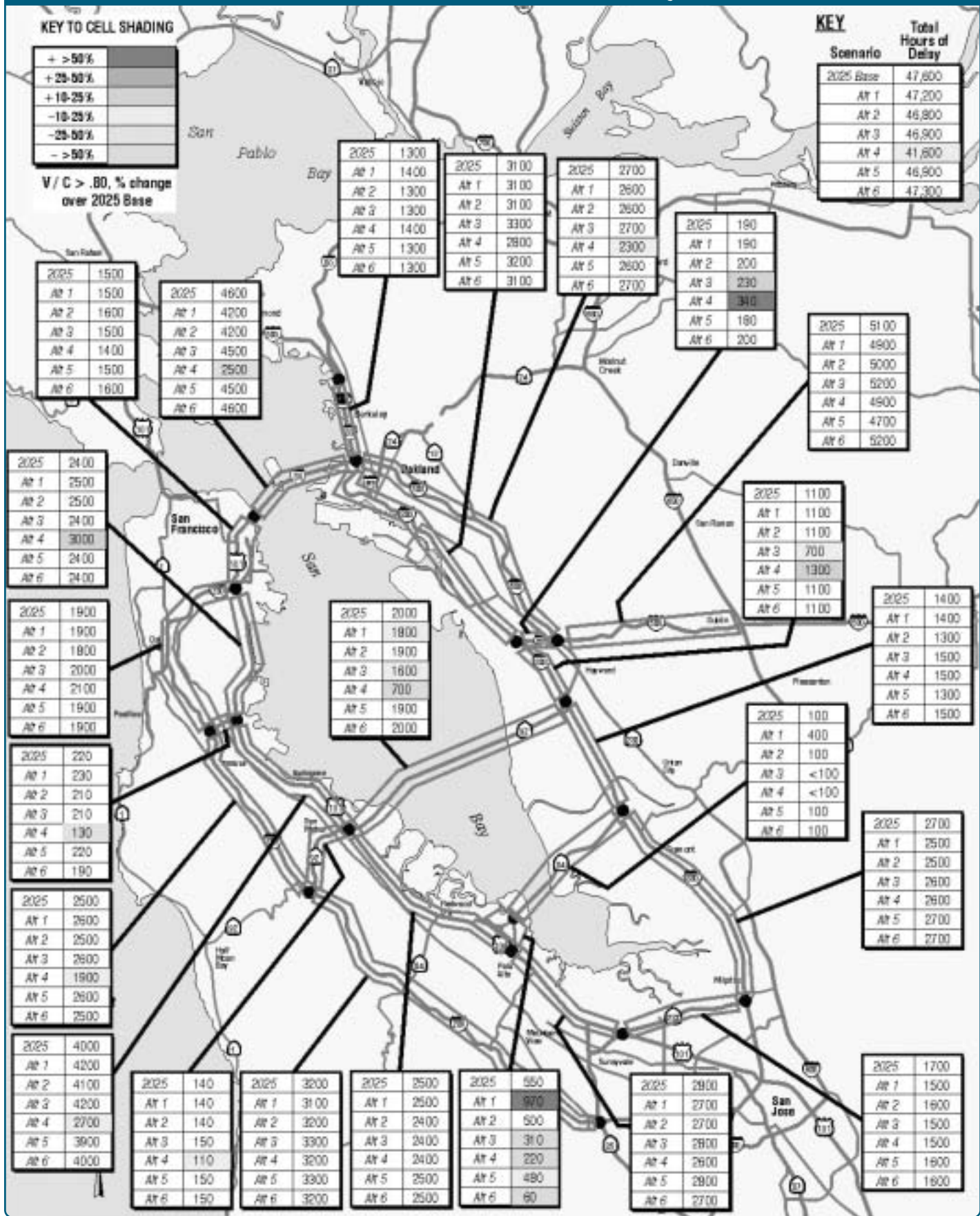


Table 13: Annual Travel-Time Savings in 2025 (millions of hours)

Alternative	Transit	Auto	Truck	Total
1 — HOV/Express Bus/Operational	3.22	2.17	0.11	5.49
2 — Bay Bridge Corridor Rail	5.55	1.05	0.08	6.68
3 — San Mateo-Hayward Bridge Widening	0.63	6.45	0.08	7.16
4 — New Mid-Bay Bridge	0.98	17.17	0.41	18.55
5 — Dumbarton Rail Service	2.33	2.06	0.10	4.48
6 — Dumbarton Approach Roadways	-0.12	4.72	0.16	4.76

Figure 26: Annual Travel-Time Savings

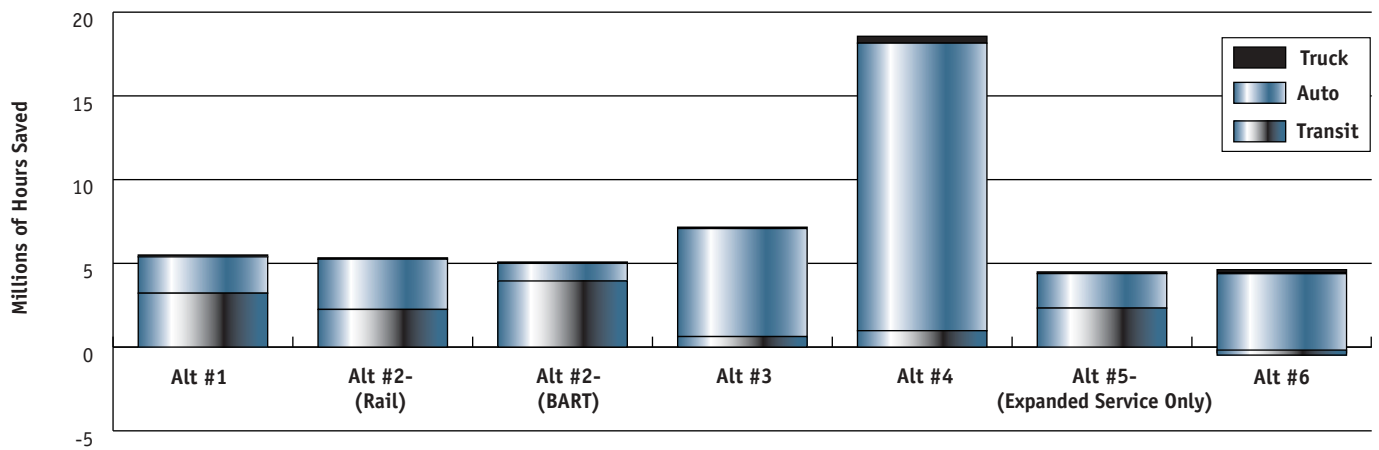


Table 14: Cost-Effectiveness

Alternative	Net Annual Operations & Maintenance Cost	Annualized Cost	Total Travel-Time Savings	Hours Saved per Million Dollars
1 — HOV/Express Bus/Operational				
High Cost (all improvements)	\$26,600,000	\$89,400,038	5,493,900	61,453
Low Cost (w/o 3 high-cost improvements)	\$26,500,000	\$68,237,662	5,493,900	80,511
2 — Bay Bridge Corridor Rail				
Alternative 2 — BART Low-Cost Estimate	\$56,600,000	\$678,192,677	5,013,450	7,392
Alternative 2 — BART High-Cost Estimate	\$56,600,000	\$956,475,056	5,013,450	5,242
Alternative 2 — Rail Low-Cost Estimate	\$11,100,000	\$669,423,712	4,560,300	6,812
Alternative 2 — Rail High-Cost Estimate	\$11,100,000	\$1,046,036,904	4,560,300	4,360
3 — San Mateo-Hayward Bridge Widening				
Alternative 3 — Low-Cost Estimate	\$2,600,000	\$180,472,090	7,163,400	39,693
Alternative 3 — High-Cost Estimate	\$2,600,000	\$207,202,090	7,163,400	34,572
4 — New Mid-Bay Bridge				
Alternative 4 — Low-Cost Estimate	\$26,300,000	\$608,143,060	18,554,400	30,510
Alternative 4 — High-Cost Estimate	\$26,300,000	\$748,838,251	18,554,400	24,778
5 — Dumbarton Rail Bridge				
Alternative 5 — Basic	\$3,300,000	\$19,054,000	n/a	n/a
Alternative 5 — Expanded	\$14,200,000	\$39,275,552	4,482,900	114,140
6 — Dumbarton Approach Roadways				
Alternative 6 — Low-Cost Estimate	\$135,200	\$59,043,612	4,757,400	80,574
Alternative 6 — High-Cost Estimate	\$135,200	\$166,344,038	4,757,400	28,600

Figure 27: Annual Travel-Time Savings per Million Dollars Invested

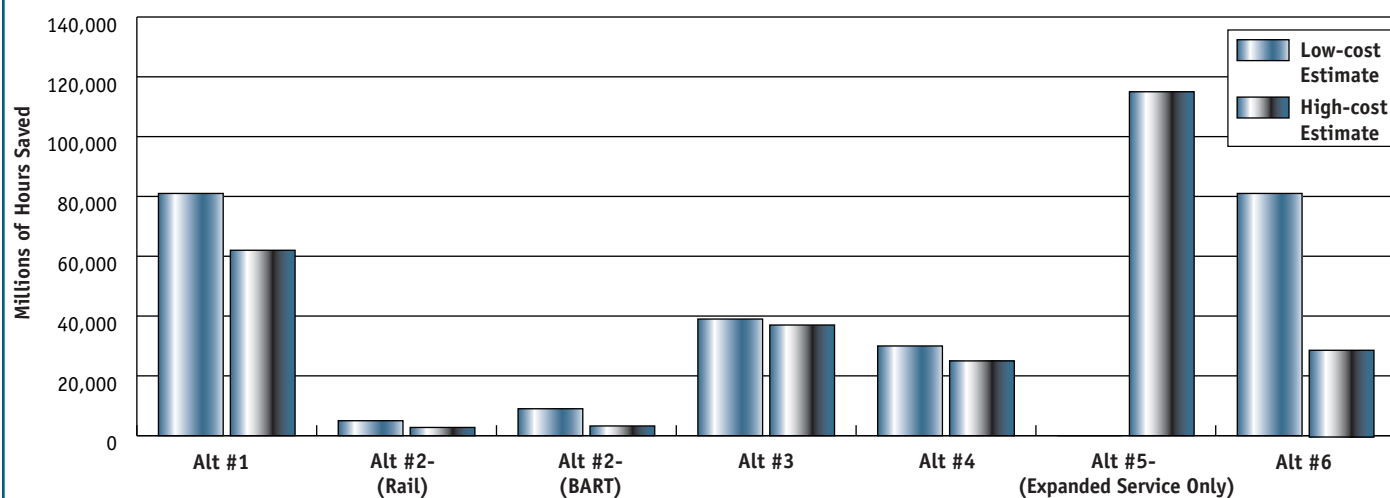


Table 15: Daily Vehicle Volumes on Bridges in the Study Area in 2025 (Sensitivity Analysis)

Bridge	Baseline 2025	Sensitivity Tests				Alt 4 2025	Sensitivity Tests	
		Congestion Pricing 2025	HOV Occupancy 2025	Blueprint Analysis 2025	Land Use 2020		Alt 4 Accessibility Changes 2025	Alt 4 with \$9 Toll 2025
Bay Bridge	425,200	423,200	409,700	426,000	414,800	401,900	404,000	391,500
New Mid-Bay Bridge	n/a	n/a	n/a	n/a	n/a	86,100	90,300	84,300
San Mateo-Hayward Bridge	159,500	155,900	140,500	158,400	127,100	121,200	126,300	119,500
Dumbarton Bridge	101,400	102,300	102,600	98,800	93,200	103,300	105,900	103,800
Total Bridges	686,100	681,400	652,800	683,200	635,100	712,500	726,500	699,100

Table 16: Daily Transbay Transit Trips in the Study Area in 2025 (Sensitivity Analysis)

	Baseline 2025	Sensitivity Tests				Alt 4 2025	Sensitivity Tests	
		Congestion Pricing 2025	HOV Occupancy 2025	Blueprint Analysis 2025	Land Use 2020		Alt 4 Accessibility Changes 2025	Alt 4 with \$9 Toll 2025
Bay Bridge								
BART	254,000	257,600	220,900	251,700	267,500	243,600	230,800	238,100
Commuter Rail	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bus	19,800	19,900	65,600	20,600	24,700	20,800	26,500	27,400
Ferry	7,100	7,100	8,600	6,900	5,800	8,100	10,000	10,100
Bay Bridge TOTAL	280,900	284,600	295,100	279,200	298,000	272,500	267,300	275,600
New Mid-Bay Bridge								
Bus	n/a	n/a	n/a	n/a	n/a	1,200	2,100	2,400
San Mateo-Hayward Bridge								
Bus	n/a	n/a	11,200	n/a	n/a	n/a	n/a	n/a
Dumbarton Bridge								
Bus	1,300	1,300	3,900	900	1,200	1,200	1,500	1,600
Dumbarton Rail	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dumbarton TOTAL	1,300	1,300	3,900	900	1,200	1,200	1,500	1,600
All Bridges	282,200	285,900	310,200	280,100	299,200	274,900	270,900	279,600

Table 17: Peak-Period Vehicle Hours of Delay on Bridges in Study Area (Sensitivity Analysis)

Bridge	Baseline 2025	Sensitivity Tests				Alt 4 2025	Sensitivity Tests	
		Congestion Pricing 2025	HOV Occupancy 2025	Blueprint Analysis 2025	Land Use 2020		Alt 4 Accessibility Changes 2025	Alt 4 with \$9 Toll 2025
Bay Bridge	73,400	71,300	58,700	72,400	53,700	44,900	46,500	41,000
New Mid-Bay Bridge	n/a	n/a	n/a	n/a	n/a	18,900	21,400	18,300
San Mateo-Hayward Bridge	37,900	36,900	34,000	35,000	17,500	19,400	20,800	18,700
Dumbarton Bridge	15,000	14,500	20,300	14,600	8,800	13,900	14,200	13,400
Total Bridges	126,200	122,700	113,000	122,000	80,000	97,200	102,800	91,400

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- Miguel Iglesias, MTC planner who took the lead in preparing travel demand forecasts for the study.



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